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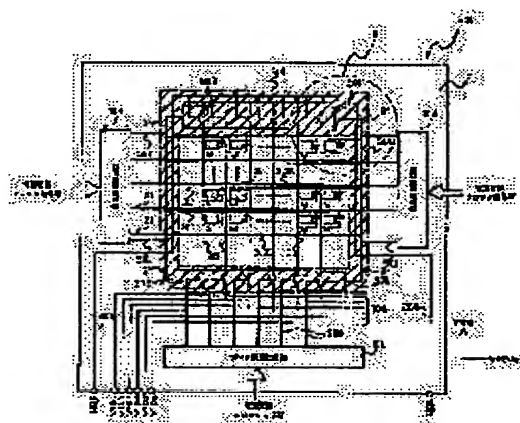
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(54) LIQUID CRYSTAL DEVICE, ELECTRONIC EQUIPMENT, AND PROJECTION DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain image display of high quality by superior switching by improving light shielding against return light, etc., from below TFTs(thin film transistor) of a precharge circuit, a sampling circuit, etc., in an active matrix drive liquid crystal device.

SOLUTION: The liquid crystal device 200 is equipped with a liquid crystal layer sandwiched between a couple of substrates, pixel electrodes 11 which are provided in matrix on the substrate, and TFTs 30 which perform switching control over them. A light shield layer is provided below those TFTs 30 and the TFTs 202 to 302 of the precharge circuit 201 and sampling circuit 301.

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【特許請求の範囲】

【請求項1】 一対の第1及び第2基板との間に液晶が挟持されてなり、

前記第1基板上には、複数の走査線と、前記複数の走査線に交差する複数のデータ線と、前記複数の走査線とデータ線に接続された複数の第1スイッチング素子と、前記複数の第1スイッチング素子に接続された複数の画素電極とを有し、

複数の第2スイッチング素子により画像信号をサンプリングして前記複数のデータ線に供給するサンプリング回路と、複数の第3スイッチング素子により前記複数のデータ線に所定電圧レベルのプリチャージ信号を前記画像信号に先行して夫々供給するプリチャージ回路とのうち少なくとも一方の回路が前記第1基板に配置されており、

前記第1スイッチング素子並びに前記少なくとも一方の回路が有する前記第2及び第3スイッチング素子のうちの少なくとも一方の素子に夫々対向する位置において、前記第1基板と前記第1スイッチング素子及び該一方の素子との間に夫々設けられた遮光層を更に備えたことを特徴とする液晶装置。

【請求項2】 前記第1、第2及び第3スイッチング素子のうち少なくとも一つは、薄膜トランジスタからなり、前記遮光層上に絶縁膜を介して形成された該薄膜トランジスタを構成する半導体層を含むことを特徴とする請求項1に記載の液晶装置。

【請求項3】 前記第1、第2及び第3スイッチング素子のうち少なくとも一つは、LDD (Lightly Doped Drain) 構造の薄膜トランジスタからなり、前記遮光層は少なくとも該薄膜トランジスタのチャネル領域及びLDD領域に対向する位置に設けられていることを特徴とする請求項1又は2に記載の液晶装置。

【請求項4】 前記遮光層は全域に渡って同一の薄膜形成工程により同一材料から形成されていることを特徴とする請求項1から3のいずれか一項に記載の液晶装置。

【請求項5】 前記遮光層は、定電位源に接続されていることを特徴とする請求項1から4のいずれか一項に記載の液晶装置。

【請求項6】 前記定電位源の定電位は、接地電位に等しいことを特徴とする請求項5に記載の液晶装置。

【請求項7】 前記第2基板の前記液晶に対面する側に設けられた対向電極を更に備えており、前記定電位源の定電位は、前記対向電極の電位に等しいことを特徴とする請求項5に記載の液晶装置。

【請求項8】 前記第1、第2及び第3スイッチング素子のうち少なくとも一つは、Nチャネル型、Pチャネル型及び相補型のうちのいずれか一つの型の薄膜トランジスタからなることを特徴とする請求項1から7のいずれか一項に記載の液晶装置。

【請求項9】 前記第1及び第2基板に平行な平面上で

前記複数の画素電極により規定される画面表示領域の周囲において前記第1及び第2基板を貼り合わせて前記液晶を包囲するシール部材と、

前記平面上で前記シール部材と前記画面表示領域との間において前記画面表示領域の輪郭に沿って前記第2基板に形成された遮光性の周辺見切りとを更に備えており、前記少なくとも一方の回路は、前記周辺見切りに対向する位置に設けられたことを特徴とする請求項1から8のいずれか一項に記載の液晶装置。

【請求項10】 前記プリチャージ回路が設けられており、

前記複数のデータ線は、前記データ線の一方側から前記画像信号が供給されると共に、他方側から前記プリチャージ信号が供給されることを特徴とする請求項1から9のいずれか一項に記載の液晶装置。

【請求項11】 当該液晶装置に対し所定の検査を行うための第4スイッチング素子を含む検査回路が前記第1基板に更に設けられており、

前記遮光層は、前記第4スイッチング素子に対向する位置において前記第1基板と前記第4スイッチング素子との間に更に設けられたことを特徴とする請求項1から10のいずれか一項に記載の液晶装置。

【請求項12】 請求項1に記載の液晶装置において、前記少なくとも一方の回路に代えて、当該液晶装置を動作させるための電圧保持用の第5スイッチング素子を含む周辺回路が前記第1基板に設けられており、

前記遮光層は、前記第5スイッチング素子に対向する位置において前記第1基板と前記第5スイッチング素子との間に設けられたことを特徴とする液晶装置。

【請求項13】 請求項1から12に記載の液晶装置を備えたことを特徴とする電子機器。

【請求項14】 光源と、該光源から出射される光が入射されて画像情報に対応した変調を施す液晶ライトバルブと、前記液晶ライトバルブにより変調された光を投射する投射手段とを有する投射型表示装置において、

前記液晶ライトバルブは、光の入射側に配置された第1基板及び出射側に配置された第2基板との間に液晶が挟持された液晶装置と、前記第1基板の外側に配置された第1偏光手段と、前記第2基板の外側に配置された第2偏光手段とを有し、

前記第2基板上には、複数の走査線と、前記複数の走査線に交差する複数のデータ線と、前記複数の走査線とデータ線に接続された複数の第1薄膜トランジスタと、前記複数の第1薄膜トランジスタに接続された複数の画素電極とを有し、

前記第2基板と前記第1薄膜トランジスタの間には前記第1薄膜トランジスタの少なくともチャネル領域に対応して遮光層が配置されてなり、

前記第2偏光手段と前記液晶装置との間には空間が形成されてなることを特徴とする投射型表示装置。

【請求項 15】 光源と、該光源から出射される光束を少なくとも 2 色の色光束に分離する色分離手段と、前記色分離手段によって分離された各色の光束に対して画像情報に対応した変調を施す液晶ライトバルブと、前記液晶ライトバルブにより変調された光を合成する合成手段と、前記合成手段から出射された合成光束を投射する投射手段とを有する投射型表示装置において、前記液晶ライトバルブは、光の入射側に配置された第 1 基板及び光の出射側に配置された第 2 基板との間に液晶が挟持されてなる液晶装置と、前記第 1 基板の外側に配置された第 1 偏光手段と、前記第 2 基板の外側に配置された第 2 偏光手段とを有し、前記第 2 基板上には、複数の走査線と、前記複数の走査線に交差する複数のデータ線と、前記複数の走査線とデータ線に接続された複数の第 1 薄膜トランジスタと、前記複数の第 1 薄膜トランジスタに接続された複数の画素電極とを有し、前記第 2 基板と前記第 1 薄膜トランジスタとの間には前記第 1 薄膜トランジスタの少なくともチャンネル領域に対応して遮光層が配置されてなり、前記第 2 偏光手段は、前記合成手段に貼りつけられていることを特徴とする投射型表示装置。

【請求項 16】 前記合成手段がプリズムユニットからなることを特徴とする請求項 15 に記載の投射型表示装置。

【請求項 17】 前記液晶装置と、前記第 2 偏光手段との間に風を送るための送風手段を更に備えたことを特徴とする請求項 14 乃至請求項 16 のいずれか一項に記載の投射型表示装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は、薄膜トランジスタ（以下適宜、TFT と称す）駆動によるアクティブマトリクス駆動方式の液晶装置及びこれを用いた電子機器の技術分野に属し、特に、液晶プロジェクタ等に用いられる、TFT の下側に遮光層を設けた形式の液晶装置及びこれを用いた電子機器の技術分野に属する。

【0002】

【従来の技術】 従来、この種の液晶装置が液晶プロジェクタ等にライトバルブとして用いられる場合には一般に、液晶層を挟んで TFT アレイ基板に対向配置される対向基板の側から投射光が入射される。ここで、投射光が TFT のアモルファスシリコン膜やポリシリコン膜から構成されたチャンネル形成用の領域に入射すると、この領域において光電変換効果により光電流が発生してしまい TFT のトランジスタ特性が劣化する。このため、対向基板には、各 TFT に夫々対向する位置に、Cr（クロム）などの金属材料や樹脂ブラックなどから遮光層が形成されるのが一般的である。

【0003】 更に、この種の液晶装置においては、特に

トップゲート構造（即ち、TFT アレイ基板上においてゲート電極がチャンネルの上側に設けられた構造）を採る正スタガ型又はコプラナー型のアモルファスシリコン又はポリシリコン TFT を用いる場合には、投射光の一部が液晶プロジェクタ内の投射光学系により戻り光として、TFT アレイ基板の側から TFT のチャンネルに入射するのを防ぐ必要がある。同様に、投射光が通過する際の TFT アレイ基板の表面からの反射光や、更にカラー用に複数の液晶装置を組み合わせる使用する場合の他の液晶装置から出射した後に投射光学系を突き抜けてくる投射光の一部が、戻り光として TFT アレイ基板の側から TFT のチャンネル領域に入射するのを防ぐ必要もある。このために、特開平 9-127497 号公報、特公平 3-52611 号公報、特開平 3-125123 号公報、特開平 8-171101 号公報等では、石英基板等からなる TFT アレイ基板上において TFT に対向する位置（即ち、TFT の下側）にも、例えば不透明な高融点金属から遮光層を形成した液晶装置を提案している。

【0004】 他方で、この種の液晶装置においては、走査線駆動回路、データ線駆動回路、プリチャージ回路、サンプリング回路、検査回路などの TFT を構成要素とする各種の周辺回路が、このような TFT アレイ基板の上に設けられる場合がある。

【0005】 これらの周辺回路のうち、プリチャージ回路は、コントラスト比の向上、データ線の電位レベルの安定、表示画面上のラインむらの低減等を目的として、データ線に対し、データ線駆動回路から供給される画像信号に先行するタイミングで、プリチャージ信号（画像補助信号）を供給することにより、画像信号をデータ線に書き込む際の負荷を軽減する回路である。特に液晶を交流駆動するために通常行われるデータ線の電圧極性を所定周期で反転して駆動する所謂 1H 反転駆動方式においては、プリチャージ信号をデータ線に予め書き込んでおけば、画像信号をデータ線に書き込む際に必要な電気量を顕著に少なくできる。例えば、特開平 7-295520 号公報に、このようなプリチャージ回路の一例が開示されている。

【0006】 サンプリング回路は、高周波数の画像信号を各データ線に所定のタイミングで安定的に走査信号と同期して供給するために、画像信号をサンプリングする回路である。また、検査回路は、製造途中や出荷時の液晶装置の品質、欠陥等を検査するための回路である。その外にも、液晶表示における画質の向上、消費電力の低減、コストの低減等の観点から、TFT 等を用いた各種の周辺回路を TFT アレイ基板上に設けることも可能である。

【0007】 ところで、この種の液晶装置内に封止された液晶に直流電圧を印加すると、液晶の劣化を招くことが知られている。このため一般には、液晶を直流駆動することは行われておらず、各画素に対する画像信号を例

例えば1フィールド毎などの所定周期で電圧極性反転することにより、液晶を交流駆動するようにしている。しかるに前述の周辺回路を、液晶に面する基板部分に設けると、周辺回路における直流電圧成分が大なり小なり液晶に印加されてしまい、上記直流駆動した場合と同様に液晶の劣化を招いてしまう。従って、これらの周辺回路を液晶に面する基板部分に設けることは一般的ではない。また、周辺回路を液晶に面する基板部分に設けることは、有効表示面積を相対的に減じてしまう観点からも一般的ではない。このため、これらの周辺回路は、プラス

【0008】

【発明が解決しようとする課題】液晶装置においては、周辺回路を加えた液晶モジュールのサイズが同じであれば、マトリクス状に配置された複数の画素電極により規定される画面表示領域、即ち液晶装置上で実際に液晶の配向状態の変化により画像が表示される領域は、大きい程よいという一般的な要請がある。

【0009】しかしながら、前述の周辺回路を遮光性のケースに納められた基板の周辺部分に設ける構成では、必然的にこのケース部分の幅が増してしまい、上記一般的な要請に答えることが出来ない。逆に、これらの周辺回路を無理に、狭く細長い周辺部分に設けると、特定の仕様に沿うようにこれら周辺回路を設計することが困難になるという問題点がある。

【0010】また、画面表示領域にある液晶に面する基板部分に周辺回路を設けたのでは、周辺回路を構成するTFTに対向基板側から投射光が入射したり、TFTアレイ基板側から戻り光が入射してしまう。このため、光電流が発生してTFTのトランジスタ特性が劣化してしまうという問題点がある。これに加えて、画面表示領域にある液晶に面する基板部分に周辺回路を設けたのでは、有効表示面積の減少を招くと共に、直流電圧が周辺回路から液晶に印加されるのを防ぐための特殊構成が必要となるという問題点もある。

【0011】本発明は上述した問題点に鑑みなされたものであり、プリチャージ回路、サンプリング回路、検査回路等の周辺回路が有するTFT等のスイッチング素子の下側からの戻り光等の光に対する遮光性能が高く、優れたスイッチング特性により高品質の画像表示が可能な液晶装置及び当該液晶装置を備えた電子機器を提供することを課題とする。

【0012】

【課題を解決するための手段】請求項1に記載の液晶装置は上記課題を解決するために、一対の第1及び第2基

板との間に液晶が挟持されてなり、前記第1基板上には、複数の走査線と、前記複数の走査線に交差する複数のデータ線と、前記複数の走査線とデータ線に接続された複数の第1スイッチング素子と、前記複数の第1スイッチング素子に接続された複数の画素電極とを有し、複数の第2スイッチング素子により画像信号をサンプリングして前記複数のデータ線に供給するサンプリング回路と、複数の第3スイッチング素子により前記複数のデータ線に所定電圧レベルのプリチャージ信号を前記画像信号に先行して夫々供給するプリチャージ回路とのうち少なくとも一方の回路が前記第1基板上に配置されており、前記第1スイッチング素子並びに前記少なくとも一方の回路が有する前記第2及び第3スイッチング素子のうちの少なくとも一方の素子に夫々対向する位置において、前記第1基板と前記第1スイッチング素子及び該一方の素子との間に夫々設けられた遮光層を更に備えたことを特徴とする。

【0013】請求項1に記載の液晶装置によれば、サンプリング回路は、例えばTFT等からなる複数の第2スイッチング素子により画像信号をサンプリングして複数のデータ線に供給する。プリチャージ回路は、例えばTFT等からなる複数の第3スイッチング素子により複数のデータ線に所定電圧レベルのプリチャージ信号を画像信号に先行して夫々供給する。これらのサンプリング回路とプリチャージ回路とのうち少なくとも一方の回路は、第1基板上に設けられている。ここで、第1スイッチング素子並びに該少なくとも一方の回路が有する第2及び第3スイッチング素子のうちの少なくとも一方の素子に夫々対向する位置には、遮光層が、第1基板と第1スイッチング素子及び該一方の素子との間に夫々設けられている。従って、仮に第1基板の側から戻り光等が入射しても、例えばTFT等からなる第1、第2及び第3スイッチング素子に入射する以前に、これらに対向する位置に夫々形成された遮光層により、この戻り光等は遮光される。このため、例えばTFT等からなる第1、第2及び第3スイッチング素子において光電変換効果により光電流が発生してスイッチング特性が劣化する事態は未然に防止される。更にこのように、サンプリング回路やプリチャージ回路についての遮光が施されているため、これらの回路を従来のように遮光性のケースに入れられた第1基板の周辺部分に配置する必要はなくなる。例えば、これらの回路を第2基板上に形成された遮光性の周辺見切りに対向する第1基板部分に配置することもできる。

【0014】請求項2に記載の液晶装置は上記課題を解決するために請求項1に記載の液晶装置において、前記第1、第2及び第3スイッチング素子のうち少なくとも一つは、薄膜トランジスタからなり、前記遮光層上に絶縁膜を介して形成された該薄膜トランジスタを構成する半導体層を含むことを特徴とする。

【0015】請求項2に記載の液晶装置によれば、第1、第2及び第3スイッチング素子のうち少なくとも一つは、遮光層上に絶縁膜を介して形成された薄膜トランジスタ(TFT)を構成する半導体層を含むが、仮に第1基板の側から戻り光等が入射しても、該半導体層に入射する以前に、これに対向する位置に形成された遮光層により、この戻り光等は遮光される。このため、該半導体層において光電変換効果により光電流が発生して、TFTのトランジスタ特性が劣化する事態は未然に防止される。

【0016】請求項3に記載の液晶装置は上記課題を解決するために請求項1又は2に記載の液晶装置において、前記第1、第2及び第3スイッチング素子のうち少なくとも一つは、LDD構造の薄膜トランジスタからなり、前記遮光層は少なくとも該薄膜トランジスタのチャネル領域及びLDD領域に対向する位置に設けられていることを特徴とする。

【0017】請求項3に記載の液晶装置によれば、第1、第2及び第3スイッチング素子のうち少なくとも一つは、LDD構造のTFTからなるが、遮光層は少なくとも該TFTのチャネル領域及びLDD領域に対向する位置に設けられているので、仮に第1基板の側から戻り光等が入射しても、該チャネル領域及びLDD領域に入射する以前に、これらに対向する位置に形成された遮光層により、この戻り光等は遮光される。このため、該チャネル領域及びLDD領域において光電変換効果により光電流が発生して、TFTのトランジスタ特性が劣化する事態は未然に防止される。

【0018】請求項4に記載の液晶装置は上記課題を解決するために請求項1から3のいずれか一項に記載の液晶装置において、前記遮光層は全域に渡って同一の薄膜形成工程により同一材料から形成されていることを特徴とする。

【0019】請求項4に記載の液晶装置によれば、遮光層は各種のスイッチング素子に対して設けられているが、遮光層はその全域に渡って同一の薄膜形成工程により同一材料から形成されている。即ちこの場合、当該液晶装置の製造工程においては、各種のスイッチング素子に対する遮光層を同一の工程により形成することが可能となる。

【0020】請求項5に記載の液晶装置は上記課題を解決するために請求項1から4のいずれか一項に記載の液晶装置において、前記遮光層は、定電位源に接続されていることを特徴とする。

【0021】請求項5に記載の液晶装置によれば、遮光層は定電位源に接続されているので、遮光層は定電位とされる。従って、遮光層に対向配置されるTFT等のスイッチング素子に対し遮光層の電位変動が悪影響を及ぼすことはない。

【0022】請求項6に記載の液晶装置は上記課題を解

決するために請求項5に記載の液晶装置において、前記定電位源の定電位は、接地電位に等しいことを特徴とする。

【0023】請求項6に記載の液晶装置によれば、遮光層は接地電位とされるので、遮光層に対向配置されるTFT等のスイッチング素子に対し遮光層の電位変動が悪影響を及ぼすことはない。

【0024】請求項7に記載の液晶装置は上記課題を解決するために請求項5に記載の液晶装置において、前記第2基板の前記液晶に対面する側に設けられた対向電極を更に備えており、前記定電位源の定電位は、前記対向電極の電位に等しいことを特徴とする。

【0025】請求項7に記載の液晶装置によれば、遮光層は対向電極の電位とされるので、遮光層に対向配置されるTFT等のスイッチング素子に対し遮光層の電位変動が悪影響を及ぼすことはない。

【0026】請求項8に記載の液晶装置は上記課題を解決するために請求項1から7のいずれか一項に記載の液晶装置において、前記第1、第2及び第3スイッチング素子のうち少なくとも一つは、Nチャネル型、Pチャネル型及び相補型のうちのいずれか一つの型の薄膜トランジスタからなることを特徴とする。

【0027】請求項8に記載の液晶装置によれば、第1、第2及び第3スイッチング素子のうち少なくとも一つは、Nチャネル型、Pチャネル型及び相補型のうちのいずれか一つの型のTFTからなるが、遮光層は少なくとも該TFTに対向する位置に設けられているので、仮に第1基板の側から戻り光等が入射しても、該TFTに入射する以前に、これに対向する位置に形成された遮光層により、この戻り光等は遮光される。このため、該TFTにおいて光電変換効果により光電流が発生して、TFTのトランジスタ特性が劣化する事態は未然に防止される。

【0028】請求項9に記載の液晶装置は上記課題を解決するために請求項1から8のいずれか一項に記載の液晶装置において、前記第1及び第2基板に平行な平面上で前記複数の画素電極により規定される画面表示領域の周囲において前記第1及び第2基板を貼り合わせて前記液晶を包囲するシール部材と、前記平面上で前記シール部材と前記画面表示領域との間において前記画面表示領域の輪郭に沿って前記第2基板に形成された遮光性の周辺見切りとを更に備えており、前記少なくとも一方の回路は、前記周辺見切りに対向する位置に設けられたことを特徴とする。

【0029】請求項9に記載の液晶装置によれば、遮光性の周辺見切りは、液晶を包囲するシール部材と画面表示領域との間において画面表示領域の輪郭に沿って第2基板に形成されている。ここで、サンプリング回路及びプリチャージ回路のうち少なくとも一方の回路は、周辺見切りに対向する位置に設けられているので、周辺見切

りという言わばデッドスペースの有効利用を図ることができる。この場合特に、周辺見切りは遮光性であるので、投射光等が第2基板の側から入射しても、これらのサンプリング回路やプリチャージ回路が有するスイッチング素子に入射する以前に、周辺見切りにより、この投射光等は遮光される。従って、投射光等に起因して、スイッチング素子において光電変換効果により光電流が発生してスイッチング特性が劣化する不都合はない。このように周辺見切りに対向する位置にサンプリング回路やプリチャージ回路を配置すると、第2基板側からの光に

【0030】請求項10に記載の液晶装置は上記課題を解決するために請求項1から9のいずれか一項に記載の液晶装置において、前記プリチャージ回路が設けられており、前記複数のデータ線は、前記データ線の一方側から前記画像信号が供給されると共に、他方側から前記プリチャージ信号が供給されることを特徴とする。

【0031】請求項10に記載の液晶装置によれば、複数のデータ線は、前記データ線の一方側から画像信号が供給され、前記データ線の他方側からプリチャージ信号が供給される。従って、プリチャージ回路を、画像信号を供給するためのデータ線駆動回路、サンプリング回路等と画面表示領域を挟んで反対の側に設けることができる。

【0032】請求項11に記載の液晶装置は上記課題を解決するために請求項1から10のいずれか一項に記載の液晶装置において、当該液晶装置に対し所定の検査を行うための第4スイッチング素子を含む検査回路が前記第1基板に更に設けられており、前記遮光層は、前記第4スイッチング素子に対向する位置において前記第1基板と前記第4スイッチング素子との間に更に設けられたことを特徴とする。

【0033】請求項11に記載の液晶装置によれば、検査回路が有する第4スイッチング素子に対向する位置には、遮光層が、第1基板と該第4スイッチング素子との間に設けられている。従って、仮に第1基板の側から戻り光等が入射しても、例えばTFT等からなる第4スイッチング素子に入射する以前に、これに対向する位置に夫々形成された遮光層により、この戻り光等は遮光される。このため、例えばTFT等からなる第4スイッチング素子において光電変換効果により光電流が発生し、スイッチング特性が劣化する事態は未然に防止される。更にこのように、検査回路についての遮光が施されているため、例えば第2基板に形成された遮光性の周辺見切りに対向する第1基板部分に配置することもできる。

【0034】請求項12に記載の液晶装置は上記課題を解決するために請求項1に記載の液晶装置において、前記少なくとも一方の回路に代えて、当該液晶装置を動作させるための電圧保持用の第5スイッチング素子を含む周辺回路が前記第1基板に設けられており、前記遮光層

は、前記第5スイッチング素子に対向する位置において前記第1基板と前記第5スイッチング素子との間に設けられたことを特徴とする。

【0035】請求項12に記載の液晶装置によれば、周辺回路が有する第5スイッチング素子に対向する位置には、遮光層が、第1基板と該第5スイッチング素子との間に設けられている。従って、仮に第1基板の側から戻り光等が入射しても、例えばTFT等からなる第5スイッチング素子に入射する以前に、これに対向する位置に夫々形成された遮光層により、この戻り光等は遮光される。このため、例えばTFT等からなる第5スイッチング素子において光電変換効果により光電流が発生してスイッチング特性が劣化して保持電圧が変化してしまう事態は未然に防止される。更にこのように、周辺回路についての遮光が施されているため、例えば第2基板に形成された遮光性の周辺見切りに対向する第1基板部分に配置することもできる。

【0036】請求項13に記載の電子機器は上記課題を解決するために請求項1から12に記載の液晶装置を備えたことを特徴とする。

【0037】請求項13に記載の電子機器によれば、電子機器は、上述した本願発明の液晶装置を備えており、戻り光等に対する遮光性能が高く優れたスイッチング特性を持つスイッチング素子により各種の動作が行われるので、高品位の画像表示が可能となる。

【0038】請求項14に記載の投射型表示装置は、光源と、該光源から出射される光が入射されて画像情報に対応した変調を施す液晶ライトバルブと、前記液晶ライトバルブにより変調された光を投射する投射手段とを有する投射型表示装置において、前記液晶ライトバルブは、光の入射側に配置された第1基板及び出射側に配置された第2基板との間に液晶が挟持された液晶装置と、前記第1基板の外側に配置された第1偏光手段と、前記第2基板の外側に配置された第2偏光手段とからなり、前記第2基板上には、複数の走査線と、前記複数の走査線に交差する複数のデータ線と、前記複数の走査線とデータ線に接続された複数の第1薄膜トランジスタと、前記複数の第1薄膜トランジスタに接続された複数の画素電極とを有し、前記第2基板と前記第1薄膜トランジスタとの間には前記第1薄膜トランジスタの少なくともチャネル領域に対応して遮光層が配置されてなり、前記第2偏光手段と前記液晶装置との間には空間が形成されることを特徴とする。

【0039】請求項14に記載の投射型表示装置によれば、第2基板と第1薄膜トランジスタとの間に遮光層を形成することにより、戻り光によるリーク電流を防ぐことができる。また戻り光による液晶ライトバルブへの影響を防ぐことができるため、従来のように反射防止膜付き偏光手段を液晶装置に貼り付けなくても良い。従って第2偏光手段を液晶装置に貼り付けることなく、離間形

成が可能であるため、液晶ライトバルブの温度上昇を防止することができる。

【0040】請求項15に記載の投射型表示装置は、光源と、該光源から出射される光束を少なくとも2色の色光束に分離する色分離手段と、前記色分離手段によって分離された各色の光束に対して画像情報に対応した変調を施す液晶ライトバルブと、前記液晶ライトバルブにより変調された光を合成する合成手段と、前記合成手段から出射された合成光束を投射する投射手段とを有する投射型表示装置において、前記液晶ライトバルブは、光の入射側に配置された第1基板及び光の出射側に配置された第2基板との間に液晶が挟持されてなる液晶装置と、前記第1基板の外側に配置された第1偏光手段と、前記第2基板の外側に配置された第2偏光手段とを有し、前記第2基板上には、複数の走査線と、前記複数の走査線に交差する複数のデータ線と、前記複数の走査線とデータ線に接続された複数の第1薄膜トランジスタと、前記複数の第1薄膜トランジスタに接続された複数の画素電極とを有し、前記第2基板と前記第1薄膜トランジスタとの間には前記第1薄膜トランジスタの少なくともチャネル領域に対応して遮光層が配置されてなり、前記第2偏光手段は、前記合成手段に貼りつけられていることを特徴とする。

【0041】請求項15に記載の投射型表示装置によれば、第2偏光手段が合成手段に貼り付けられているため、液晶装置と第2偏光手段との間には空間が形成される。従って、液晶装置の温度上昇を避けることができ、液晶ライトバルブの誤動作を防ぐことができる。

【0042】請求項16に記載の投射型表示装置は、請求項15に記載の投射型表示装置において、前記合成手段がプリズムユニットからなることを特徴とする。

【0043】請求項16に記載の投射型表示装置によれば、前記合成手段がプリズムユニットからなり、第2偏光手段はプリズムユニットに貼り付けられている。プリズムユニットは熱容量が大きいため、第2偏光手段の熱容量をプリズムユニットで吸収することができ、液晶ライトバルブの温度上昇を防ぐために効果的である。

【0044】請求項17に記載の投射型表示装置は、請求項15又は請求項16に記載の投射型表示装置において、前記液晶装置と、前記第2偏光手段との間に冷風を送る冷却手段を更に備えたことを特徴とする。

【0045】請求項17に記載の投射型表示装置によれば、例えば合成手段の上側あるいは下側の一方に冷却手段を設け、冷却手段から液晶装置と偏光手段との間に冷風を送ることにより、液晶ライトバルブの温度上昇をさらに防ぐことができ、液晶ライトバルブの誤動作を防ぐことができる。

【0046】本発明のこのような作用及び他の利得は次に説明する実施の形態から明らかにする。

【0047】

【発明の実施の形態】以下、本発明の実施の形態を図面に基づいて説明する。

【0048】（液晶装置の構成）液晶装置の実施の形態の構成について図1から図5に基づいて説明する。

【0049】まず、液晶装置の全体構成について、図1から図3を参照して説明する。図1は、液晶装置の実施の形態におけるTFTアレイ基板上に設けられた各種配線、周辺回路等の構成を示すブロック図であり、図2は、TFTアレイ基板をその上に形成された各構成要素と共に対向基板の側から見た平面図であり、図3は、対向基板を含めて示す図2のH-H'断面図である。

【0050】図1において、液晶装置200は、例えば石英基板、ハードガラス、シリコン基板等からなるTFTアレイ基板1を備えている。TFTアレイ基板1上には、マトリクス状に設けられた複数の画素電極11と、X方向に複数配列されており夫々がY方向に沿って伸びるデータ線35と、Y方向に複数配列されており夫々がX方向に沿って伸びる走査線31と、各データ線35と画素電極11との間に夫々介在すると共に該間における導通状態及び非導通状態を、走査線31を介して夫々供給される走査信号に応じて夫々制御するスイッチング素子の一例としての複数のTFT30とが形成されている。

またTFTアレイ基板1上には、後述の蓄積容量（図6参照）のための配線である容量線31'（第2蓄積容量電極）が、走査線31と平行に形成されている。

【0051】TFTアレイ基板1上には更に、複数のデータ線35に所定電圧レベルのプリチャージ信号を画像信号に先行して夫々供給するプリチャージ回路201と、画像信号をサンプリングして複数のデータ線35に夫々供給するサンプリング回路301と、データ線駆動回路101と、走査線駆動回路104とが形成されている。

【0052】走査線駆動回路104は、外部制御回路から供給される電源、基準クロック等に基づいて、所定タイミングで走査線31に走査信号をパルスの線順次で印加する。

【0053】データ線駆動回路101は、外部制御回路から供給される電源、基準クロック信号等に基づいて、走査線駆動回路104が走査信号を印加するタイミングに合わせて、たとえば6つの画像信号線304夫々について、データ線35毎にサンプリング回路駆動信号をサンプリング回路301にサンプリング回路駆動信号線306を介して所定タイミングで順次供給する。

【0054】プリチャージ回路201は、TFT202を各データ線35毎に備えており、プリチャージ信号線204がTFT202のソース電極に接続されており、プリチャージ回路駆動信号線206がTFT202のゲート電極に接続されている。そして、プリチャージ信号線204を介して、外部電源からプリチャージ信号（NRS）を書き込むために必要な所定電圧の電源が供給さ

れ、プリチャージ回路駆動信号線206を介して、各データ線35について画像信号(VID1~VID6)に先行するタイミングでプリチャージ信号を書き込むように、外部制御回路からプリチャージ回路駆動信号(NRG)が供給される。プリチャージ回路201は、好ましくは中間階調レベルの画素データに相当するプリチャージ信号(画像補助信号)を供給する。

【0055】サンプリング回路301は、TFT302を各データ線35毎に備えており、画像信号線304がTFT302のソース電極に接続されており、サンプリング回路駆動信号線306がTFT302のゲート電極に接続されている。そして、画像信号線304を介して、6つの平行な画像信号(VID1~VID6)が入力されると、これらの画像信号(VID1~VID6)をサンプリングする。また、サンプリング回路駆動信号線306を介して、データ線駆動回路101からサンプリング回路駆動信号が入力されると、6つの画像信号線304夫々についてサンプリングされた画像信号を、データ線3に順次印加する。即ち、データ線駆動回路101とサンプリング回路301とは、画像信号線304から入力された6相展開された平行な画像信号(VID1~VID6)をデータ線35に供給するように構成されている。本実施の形態ではデータ線35を1本毎に順次選択していく方式を述べたが、例えば、隣接する6つのデータ線35に接続されるサンプリング回路301を同時に選択し、6つのデータ線35からなるグループ毎に順次転送していく方式でもよい。データ線35の選択は、相隣接する2、3、…、5本或いは7本以上を同時に選択してもよい。また、データ線35に供給される画像信号の相展開数は6相のみならず、サンプリング回路301を構成するTFT302の書き込み特性が良ければ、5相以下でもよいし、画像信号のドット周波数が高ければ、7相以上に増やしてもよい。この際、少なくとも画像信号の相展開数だけ画像画像入力信号線が必要なことは言うまでもない。

【0056】本実施の形態では特に、各画素に設けられたTFT30、プリチャージ回路201が有するTFT202及びサンプリング回路301が有するTFT302の下側には夫々遮光層3(後述する)が設けられている。従って、仮にTFTアレイ基板1の側から戻り光等が入射しても、TFT30、202及び302に入射する以前に、これらに対向する位置に夫々形成された遮光層3により、この戻り光等は遮光される。このため、TFT30、202及び302において光電変換効果により光電流が発生してトランジスタ特性が劣化する事態は未然に防止され、フリッカーやクロストーク等の画質品位を著しく損なう不良は発生しない。尚、遮光層3の具体的な層構成については後述する。

【0057】また、本実施の形態ではTFT30、202及び302の少なくともチャンネル領域下に形成された

遮光層3は、接地電位のような定電位線と電氣的に接続するようにする。これは、TFT30、202及び302の各端子間に不安定な電位差が生じることにより起こるトランジスタ特性の変化を防ぐためである。定電位線としては、例えば、データ線駆動回路101や走査線駆動回路104等へ供給される正電位或いは負電位の電源や、対向基板2に対向電極電位を供給する配線と電氣的に接続してもよい。図1に示すように、走査線駆動回路104の負電位の電源等から延設された定電位線501は、画面表示領域の周辺で遮光層3に電氣的に接続されている。また、画素の蓄積容量を形成するための容量線31'へ供給する定電位線501と共用してもよい。このような構成を採れば、引き回し配線が1本で済むため、周辺回路を作り込むスペースが広がったり、液晶装置を小型化する際に有利である。また、専用の外部入力端子を必要としないので、スペースに余裕ができ、実装部材のコストダウンが図れる。但し、専用の外部入力端子と配線を設けて、定電位を供給してもよいことは言うまでもない。

【0058】更にこのように、プリチャージ回路201やサンプリング回路301について、TFTアレイ基板1の側からの戻り光に対して遮光が施されているため、これらの回路を従来のように遮光性のケースに入れられたTFTアレイ基板1の周辺部分に配置する必要はなくなる。そこで、本実施の形態では図1中斜線領域で示すように且つ図2及び図3に示すように、プリチャージ回路201及びサンプリング回路301は、対向基板2に形成された遮光性の周辺見切り53に対向する位置においてTFTアレイ基板1上に設けられている。他方、データ線駆動回路101及び走査線駆動回路104は、液晶層50に面しないTFTアレイ基板1の狭く細長い周辺部分上に設けられている。

【0059】図2及び図3において、TFTアレイ基板1の上には、複数の画素電極1-1により規定される画面表示領域(即ち、実際に液晶層50の配向状態変化により画像が表示される液晶装置の領域)の周囲において両基板を貼り合わせて液晶層50を包囲するシール部材の一例としての光硬化性樹脂からなるシール材52が、画面表示領域に沿って設けられている。そして、対向基板2上における画面表示領域とシール材52との間には、遮光性の周辺見切り53が設けられている。

【0060】周辺見切り53は、後に画面表示領域に対応して開口部が設けられた遮光性のケースにTFTアレイ基板1が入れられた場合に、当該画面表示領域が製造誤差等により当該ケースの開口の縁に隠れてしまわないように、即ち、例えばTFTアレイ基板1のケースに対する数百 μm 程度のずれを許容するように、画面表示領域の周囲に500 μm 以上の幅を持つ帯状の遮光性材料から形成されたものである。このような遮光性の周辺見切り53は、例えば、Cr(クロム)、Ni(ニッケル)

ル)、A1(アルミニウム)などの金属材料を用いたスパッタリング、フォトリソグラフィ及びエッチングにより対向基板2に形成される。或いは、カーボンやTi(チタン)をフォトレジストに分散した樹脂ブラックなどの材料から形成される。

【0061】シール材52の外側の領域には、画面表示領域の下辺に沿ってデータ線駆動回路101及び実装端子102が設けられており、画面表示領域の左右の2辺に沿って走査線駆動回路104が設けられている。更に画面表示領域の上辺には、画面表示領域の両側に設けられた走査線駆動回路104間をつなぐための複数の配線105が設けられている。また、対向基板2のコーナ部部の少なくとも一箇所において、TFTアレ基板1と対向基板2の間で電氣的導通をとるための導通材からなる銀点106が設けられている。そして、シール材52とほぼ同じ輪郭を持つ対向基板2が当該シール材52によりTFTアレ基板1に固着されている。

【0062】プリチャージ回路201及びサンプリング回路301は、基本的に交流駆動の回路である。このため、シール材52により包囲され両基板間に挟持された液晶層50に面するTFTアレ基板1部分にこれらのプリチャージ回路201及びサンプリング回路301を設けても、直流電圧印加による液晶層50の劣化という問題は生じない。これに対して、データ線駆動回路101及び走査線駆動回路104は、液晶層50に面することのないTFTアレ基板1の周辺部分に設けられている。従って、液晶層50に、特に直流駆動されるデータ線駆動回路101や走査線駆動回路104からの直流電圧成分が、漏れ込んで印加されることを未然に防止できる。

【0063】このように周辺見切り53下に、プリチャージ回路201及びサンプリング回路301を設けることで、走査線駆動回路104やデータ線駆動回路101をTFTアレ基板1の周辺部分に余裕を持って形成することができ、特定の仕様に沿うようにこれらの周辺回路を設計することが容易になる。また、言わばデッドスペースである周辺見切り53下に、プリチャージ回路201やサンプリング回路301を設けることで、液晶装置200における有効表示面積の減少を招くこともない。

【0064】そして一方で、周辺見切り53は遮光性であるので、対向基板2の側から入射する投射光等に対する遮光手段をプリチャージ回路201やサンプリング回路301(即ち、TFT202及び302)の上に別途設ける必要は無い。他方で、遮光層がプリチャージ回路201やサンプリング回路301(即ち、TFT202及び302)の少なくともチャンネル領域下に設けられているので、TFTアレ基板1の側から入射する戻り光等をプリチャージ回路201やサンプリング回路301(即ち、TFT202及び302)に届く前に遮光でき

る。これにより、プリチャージ回路201のTFT202、或いはサンプリング回路301のTFT302の少なくともチャンネル領域に光が照射されることがないので、この領域において光電変換効果により光電流が発生し、TFT202、302のトランジスタ特性は劣化することがない。従って、本実施の形態は、液晶装置のどちらの側から光が入射しようとも、確実に遮光できるという長所があり、フリッカーやクロストーク等の画質品位を著しく低下させる不良をなくすることができる。

10 【0065】加えて、シール材52に面するTFTアレ基板1部分にプリチャージ回路201やサンプリング回路301を形成する訳ではないので、これらの回路を構成するTFT202及び302をシール材52に混入されたスペーサにより破壊する恐れはなく、更に、シール材52を光硬化させる工程で両基板側から光を十分に照射できる。

【0066】図1に示したように本実施の形態では、複数のデータ線35は、画面表示領域の下辺にある一端から画像信号が供給され、他方の側にある他端からプリチャージ信号が供給される。従って、プリチャージ回路201を、画像信号を供給するためのデータ線駆動回路101及びサンプリング回路301と画面表示領域を挟んで反対の側に設けることができ、周辺見切り53下のスペースをバランス良く有効に利用できる。

【0067】次に、プリチャージ回路201及びサンプリング回路301を構成するTFT202及び302の具体的な回路構成について図4及び図5を参照して夫々説明する。尚、図4は、プリチャージ回路201のTFT202を構成する各種のTFTを示す回路図であり、図5は、サンプリング回路301のTFT302を構成する各種のTFTを示す回路図である。

【0068】図4(1)に示すようにプリチャージ回路201のTFT202(図1参照)は、Nチャンネル型TFT202aから構成されてもよいし、図4(2)に示すようにPチャンネル型TFT202bから構成されてもよいし、図4(3)に示すようにNチャンネル型TFT及びPチャンネル型TFTから成る相補型TFT202cから構成されてもよい。なお、図4(1)から図4(3)において、図1に示したプリチャージ回路駆動信号線206を介して入力されるプリチャージ回路駆動信号206a、206bは、ゲート電圧として各TFT202a~202cに入力される。同じく図1に示したプリチャージ信号線204を介して入力されるプリチャージ信号NRSは、ソース電圧として各TFT202a~202cに入力される。Nチャンネル型TFT202aにゲート電圧として印加されるプリチャージ回路駆動信号206aと、Pチャンネル型TFT202bにゲート電圧として印加されるプリチャージ回路駆動信号206bとは、相互に反転信号である。従って、プリチャージ回路201を相補型TFT202cで構成する場合には、プリチャ

ージ回路駆動信号線 206 が少なくとも 2 本以上必要となる。このようにプリチャージ回路駆動信号線 206 が 2 本以上になる場合、画面表示領域の一方の側に集中して配線してもよいし、プリチャージ信号線 204 と組み合わせ、画面表示領域の両側から配線してもよい。或いは、例えば、相補型 TFT 202c の手前で、プリチャージ回路駆動信号 206a をインバータにより反転させて、プリチャージ回路駆動信号 206b を形成してもよい。

【0069】図 5 (1) に示すようにサンプリング回路 301 の TFT 302 (図 1 参照) は、N チャネル型 TFT 302A から構成されてもよいし、図 5 (2) に示すように P チャネル型 TFT 302B から構成されてもよいし、図 5 (3) に示すように相補型 TFT 302C から構成されてもよい。なお、図 5 (1) から図 5

(3) において、図 1 に示した画像信号線 304 を介して入力される画像信号 VID は、ソース電圧として各 TFT 302a ~ 302c に入力される。同じく図 1 に示したデータ線駆動回路 101 からサンプリング回路駆動信号線 306 を介して入力されるサンプリング回路駆動信号 306a、306b は、ゲート電圧として各 TFT 302a ~ 302c に入力される。また、サンプリング回路 301 においても、前述のプリチャージ回路 201 の場合と同様に、N チャネル型 TFT 302a にゲート電圧として印加されるサンプリング回路駆動信号 306a と、P チャネル型 TFT 302B にゲート電圧として印加されるサンプリング回路駆動信号 306b とは、相互に反転信号である。従って、サンプリング回路 301 を相補型 TFT 302C で構成する場合には、サンプリング回路駆動信号 306a、306b 用のサンプリング回路駆動信号線 306 が少なくとも 2 本以上必要となる。

【0070】(液晶装置の構成) 次に、液晶装置 200 が含む液晶装置部分の具体的構成について図 6 から図 8 を参照して説明する。ここに、図 7 は図 1 において円で囲まれた D の領域を拡大した平面図であり、図 6 は図 7 における TFT 30 の A-A' に沿った断面図と、プリチャージ回路 201 の TFT 202 の B-B' に沿った断面図を表している。尚、図 6 においては、各層や各部材を図面上で認識可能な程度の大きさとするため、各層や各部材毎に縮尺を異ならしめてある。

【0071】図 6 の断面図において、液晶装置 200 は、各画素に設けられる TFT 30 部分において、TFT アレイ基板 1 並びにその上に積層された遮光層 3、第 1 層間絶縁層 41、半導体層 32、ゲート絶縁層 33、走査線 31 (ゲート電極)、第 2 層間絶縁層 42、データ線 35 (ソース電極)、第 3 層間絶縁層 43、画素電極 11 及び配向膜 12 を備えている。液晶装置 200 はまた、例えばガラス基板から成る対向基板 2 並びにその上に積層された共通電極 21、配向膜 22 及び第 2 遮光

層 23 を備えている。液晶装置 200 は更に、これらの両基板間に挟持された液晶層 50 を備えている。

【0072】ここでは先ず、これらの層のうち、TFT 30 を除く各層の構成について順に説明する。

【0073】TFT 30 に夫々対向する位置において TFT アレイ基板 1 上には、遮光層 3 が夫々設けられている。遮光層 3 は、Ti (チタン)、Cr (クロム)、W (タングステン)、Ta (タンタル)、Mo (モリブデン) 及び Pd (鉛) 等の少なくとも一つを含む金属、或いは金属シリサイド (例えば、タングステンシリサイド WS₂i) 等の金属合金からなる。遮光層 3 を高融点金属シリサイドから構成すると、即ち、シリコンを遮光層 3 の材料に含ませると、シリコンを含んでなる TFT アレイ基板 1 や第 1 層間絶縁層 41 との熱的相性が良くなる。

【0074】また、遮光層 3 は、図 7 に示すようにコンタクトホール 503 を介して定電位線 501 を経て、接地されているか又は定電位源に接続されている。定電位線 501 としては、データ線駆動回路 101 や走査線駆動回路 104 等の周辺回路に供給される電源等の配線を延設するとよい。このため、遮光層 3 の電位が変化することにより、TFT 30 のスイッチング特性等に悪影響を及ぼすことがない。例えば、遮光層 3 は接地されてもよいし、或いは共通電極 21 に接続されて共通電極 21 の電位にされてもよい。但し、遮光層 3 は電氣的に浮遊していてもよい。また遮光層 3 を後述の蓄積容量 (図 6 参照) 用の配線として使用することも可能である。

【0075】更に、遮光層 3 と複数の TFT 30 との間には、第 1 層間絶縁層 41 が設けられている。第 1 層間絶縁層 41 は、例えば、NSG (ノンドープシリケートガラス)、PSG (リンシリケートガラス)、BSG (ボロンシリケートガラス)、BPSG (ボロンリンシリケートガラス) などのシリケートガラス膜、窒化シリコン膜や酸化シリコン膜等からなり、TFT 30 を構成する半導体層 32 を遮光層 3 から電氣的絶縁するために設けられるものである。更に、第 1 層間絶縁層 41 は、TFT アレイ基板 1 の全面に形成されることにより、TFT 30 のための下地膜としての機能をも有する。即ち、TFT アレイ基板 1 の表面の研磨時における荒れや、洗浄後に残る汚れ等で TFT 30 の特性の劣化を防止する機能を有する。

【0076】第 2 層間絶縁層 42 及び第 3 層間絶縁層 43 は夫々、NSG、PSG、BSG、BPSG などのシリケートガラス膜、窒化シリコン膜や酸化シリコン膜等からなる。

【0077】画素電極 11 は例えば、ITO 膜 (インジウム・ティン・オキサイド膜) などの透明導電性薄膜からなる。尚、当該液晶装置 200 を反射型の液晶装置に用いる場合には、A1 等の反射率の高い不透明な材料から画素電極 11 を形成してもよい。

【0078】配向膜12は例えば、ポリイミド薄膜などの有機薄膜からなり、所定のプレティルト角を持つように且つ所定方向でラビング処理が施されている。

【0079】共通電極21は、対向基板2の全面に渡ってITO膜等から形成されている。

【0080】配向膜22は、例えば、ポリイミド薄膜などの有機薄膜からなり、所定のプレティルト角を持つように且つ所定方向でラビング処理が施されている。

【0081】第2遮光層23は、TFT30に対向する所定領域にCrやNiなどの金属材料やカーボンやTiをフォトリソに分散した樹脂ブラックなどの材料から形成されている。第2遮光層23は、TFT30の半導体層32に対する遮光の他に、コントラストの向上、色材の混色防止などの機能を有する。

【0082】液晶層50は、画素電極11と共通電極21とが対面するように配置されたTFTアレイ基板1と対向基板2との間において、シール材52（図2及び図3参照）により囲まれた空間に液晶が真空吸引等により封入されることにより形成される。液晶層50は、画素電極11からの電界が印加されていない状態で配向膜12及び22により所定の配向状態を採る。液晶層50は、例えば一種又は数種類のネマティック液晶を混合した液晶からなる。シール材52は、二つの基板1及び2をそれらの周辺で貼り合わせるための、例えば光硬化性樹脂や熱硬化性樹脂からなる接着剤であり、両基板間の距離を所定値とするためのスペーサが混入されている。

【0083】次に、TFT30に係る各層の構成について順に説明する。

【0084】TFT30は、走査線31（ゲート電極）、走査線31からの電界によりチャネルが形成される半導体層32、走査線31と半導体層32とを絶縁するゲート絶縁層33、半導体層32に形成されたソース領域34、データ線35（ソース電極）、及び半導体層32に形成されたドレイン領域36を備えている。ドレイン領域36には、複数の画素電極11のうちの対応する一つが接続されている。ソース領域34及びドレイン領域36は後述のように、半導体層32に対し、N型又はP型のTFTを形成するかに応じて所定濃度のN型用又はP型用のドーパントをドーブすることにより形成されている。N型チャネルのTFTは、動作速度が速いという利点があり、画素のスイッチング素子であるTFT30として用いられることが多い。

【0085】TFT30は、好ましくはLDD構造を持つ。但し、TFT30は、LDD構造における低濃度のソース・ドレイン領域にイオン注入を行わないオフセット構造を持ってもよいし、ゲート電極31をマスクとして自己整合的にソース領域34及びドレイン領域36を形成してもよい。セルフアライン型のTFTであってもよい。また、本実施の形態では、TFT30をシングルゲート構造で示したが、ソース領域34とドレイン領域

36の間にゲート電極31を2個直列に配設したデュアルゲート構造でもよいし、ゲート電極31を3個以上配設してもよい。このような構造を採れば、TFT30のオフ時のリーク電流が低減されるため、画質品位の劣化を引き起こすことがない。

【0086】走査線31（ゲート電極）は、好ましくはポリシリコン膜から形成される。或いは、WやMo等の高融点金属膜又は金属シリサイド膜から形成されてもよい。この場合、走査線31（ゲート電極）を、第2遮光層23が覆う領域の一部又は全部に対応する遮光膜として配置すれば、金属膜や金属シリサイド膜の持つ遮光性により、第2遮光層23の一部又は全部を省略することも可能となる。この場合特に、対向基板2とTFTアレイ基板1との貼り合わせずれによる画素開口率の低下を防ぐことが出来る利点がある。

【0087】ゲート絶縁層33は、比較的薄い厚さの熱酸化膜からなる。尚、8インチ以上の大型基板を使用する場合、熱による基板のそりを防止するために、熱酸化時間を短くして、熱酸化膜を薄くし、この熱酸化膜上に高温酸化シリコン膜（HTO膜）や窒化シリコン膜をCVD法等で堆積して、2層以上の多層ゲート絶縁膜構造を形成してもよい。

【0088】一般にチャネルが形成される半導体層32は、光が入射するとポリシリコン膜が有する光電変換効果により光電流が発生してしまいTFT30のトランジスタ特性が劣化するが、本実施の形態では、対向基板2側からの投射光等の光に対しては、対向基板2に各TFT30に夫々対向する位置に複数の第2遮光層23が形成されているので、投射された入射光が半導体層32の少なくともチャネル領域に入射することが防止される。ところで、対向基板2上に形成される第2遮光層23をTFTアレイ基板1上に形成してもよい。この場合、データ線35と画素電極11との間にそれぞれ絶縁膜を介してTi（チタン）等を形成すれば、対向基板2上の第2遮光層23は省略できる。従って、対向基板2とTFTアレイ基板1との組立時のアライメント精度を考慮する必要がないため、透過率のばらつきがない液晶装置を提供できる。

【0089】データ線35（ソース電極）は、画素電極11と同様にITO膜等の透明導電性薄膜から形成してもよい。或いは、Al等の低抵抗金属や金属シリサイド等から形成してもよい。

【0090】更にこれに加えて又は代えて、走査線31の一部からなるTFT30のゲート電極を上側から覆うようにデータ線35（ソース電極）をAl等の不透明な金属薄膜から形成すれば、第2遮光層23と共に又は単独で、半導体層32の少なくともチャネル領域への入射光（即ち、図6で上側からの光）の照射を効果的に防ぐことが出来る。ここで、データ線35は、TFT30において、少なくとも半導体層32のチャネル領域とソー

ス・ドレイン領域 34 及び 36 との接合部と、これらの下方に配設される遮光層 3 を覆うように形成するとよい。これは、対向基板 2 側から入射した光が、遮光層 3 の表面で反射して、チャンネル領域を照射するのを防ぐためである。他方、TFT アレイ基板 1 側からの戻り光等の光に対しては、TFT アレイ基板 1 に各 TFT 30 に夫々対向する位置に複数の遮光層 3 が形成されているので、戻り光等が半導体層 32 の少なくともチャンネル領域に入射することが防止される。

【0091】また、第 2 層間絶縁層 42 には、ソース領域 34 へ通じるコンタクトホール 37 及びドレイン領域 36 へ通じるコンタクトホール 38 が夫々形成されている。このソース領域 34 へのコンタクトホール 37 を介して、データ線 35（ソース電極）はソース領域 34 に電気的接続される。更に、第 3 層間絶縁層 43 には、ドレイン領域 36 へのコンタクトホール 38 が形成されている。このドレイン領域 36 へのコンタクトホール 38 を介して、画素電極 11 はドレイン領域 36 に電気的接続される。前述の画素電極 11 は、このように構成された第 3 層間絶縁層 43 の上面に設けられている。

【0092】ここで、図 7 の平面図に示すように、以上のように構成された画素電極 11 は、TFT アレイ基板 1 上にマトリクス状に配列され、各画素電極 11 に隣接して TFT 30 が設けられており、また画素電極 11 の縦横の境界に夫々沿ってデータ線 35（ソース電極）及び走査線 31（ゲート電極）が設けられている。また、遮光層 3 が TFT 30 のチャンネル部分等を下から覆っているのが分かる。図 7 において、C 方向に位置する走査線駆動回路 104 の負電位の電源から延設された定電位線 501 は、画面表示領域の直近まで配設される。ここで、遮光層 3 とコンタクトホール 503 を介して電気的に接続される。遮光層 3 は、走査線 31 に沿って平行にその下方に配設される。また、プリチャージ回路 201 の TFT 202 の少なくとも半導体層 32 のチャンネル領域下を覆うように遮光層 3 が形成され、画面表示領域の一方端から反対側の端まで、走査線 31 と平行に配線される。更にトランジスタ特性が劣化しないように定電位線 501 にコンタクトホール 503 を介して電気的に接続する。また、定電位線 501、プリチャージ回路 201、プリチャージ回路駆動信号線 206、プリチャージ信号線 204 等を従来デッドスペースであった周辺見切り 53 下に形成することにより、周辺回路を作り込む領域を拡大できたり、液晶装置の小型化が実現できる。尚、図 7 は、説明の都合上、画素電極 11 のマトリクス状配列等を簡略化して示すためのものであり、実際の各電極は層間絶縁層の間や上をコンタクトホール等を介して配線されており、図 6 から分かるように 3 次元的に複雑な構成を有している。

【0093】再び図 6 において、画素電極 11 には蓄積容量 70 が夫々設けられている。この蓄積容量 70 は、

より具体的には、半導体層 32 のドレイン領域 36 から延設形成された第 1 蓄積容量電極 32'、ゲート絶縁層 33 と同一工程により形成される絶縁層 33'、走査線 31 と同一工程により形成される容量線 31'（第 2 蓄積容量電極）、第 2 及び第 3 層間絶縁層 42 及び 43、並びに第 2 及び第 3 層間絶縁層 42 及び 43 を介して容量線 31' に対向する画素電極 11 の一部から構成されている。このように蓄積容量 70 が設けられているため、デューティ比が小さくても高精細な表示が可能とされる。また、図 7 に示すように、走査線駆動回路 104 から延設された定電位線 501 と容量線 31' をコンタクトホール 502 において電気的に接続することにより、定電位供給源として利用できる。これにより、遮光層 3 と定電位線を共用できるため、配線が 1 本で済み、配線の引き回しにおいて有利である。更に、専用の外部入力端子を設ける必要がないので、入力端子数を減らすことができる。

【0094】図 6 において、液晶装置 200 には、プリチャージ回路 201 の TFT 202（図 1 参照）がデータ線 35 毎に設けられている。この TFT 202 は、より具体的には、半導体層 32 と同一工程により形成される半導体層 32'、ゲート絶縁層 33 と同一工程により形成されるゲート絶縁層 33' 及び走査線 31（ゲート電極）と同一工程により形成されるプリチャージ回路駆動信号線 206（ゲート電極）を備えている。半導体層 32' には、TFT 30 の場合と同様に、ソース領域 34' 及びドレイン領域 36' が設けられ、第 2 層間絶縁層 42 に開けられたコンタクトホール 38' を通じてドレイン領域 36' にはデータ線 35 が接続されている。また、第 2 層間絶縁層 42 に開けられたコンタクトホール 37' を通じてソース領域 34' にはプリチャージ信号線 204 が接続されている。そして、このような層構造を持つ TFT 202 に対向する位置において TFT アレイ基板 1 上に、遮光層 3 と同一工程により形成される遮光層 3' が少なくとも半導体層 32' のチャンネル領域下を覆うように設けられている。しかも、TFT 202 は、対向基板 2 に設けられた遮光性の周辺見切り 53 に対向する位置において、TFT アレイ基板 1 上に設けられている。これにより、光が透過する開口領域の直近に周辺回路を形成することが可能となる。

【0095】図 7 の平面図に示すように、プリチャージ回路 201 は、プリチャージ信号線 204、プリチャージ回路駆動信号線 206 及びデータ線 35 が平行に配置されている。尚、パターンレイアウトは必ずしも平行に配置する必要はない。プリチャージ信号線 204 は、各コンタクトホール 37' を介して各 TFT 202 のソース領域に電気的接続されており、データ線 35 は各コンタクトホール 38' を介して各 TFT 202 のドレイン領域に電気的接続されている。また、プリチャージ回路駆動信号線 206 は TFT 202 のゲート電極として、

これらのソース領域とドレイン領域とを結ぶチャネル部分にゲート絶縁膜を介して対向配置されている。そして、チャネル部分をゲート電極と共に平面図で覆うように遮光層 3” が設けられている。

【0096】尚、図 7 には図示していないが、サンプリング回路 301 の TFT 302 (図 1 参照) は、プリチャージ回路 201 の TFT 202 と同様に構成されており、TFT 302 に対向する位置において TFT アレイ基板 1 上に、遮光層 3” が設けられている。しかも、TFT 302 は、対向基板 2 に設けられた遮光性の周辺見切り 53 に対向する位置において、TFT アレイ基板 1 上に設けられている。

【0097】本実施の形態では特に、TFT 30 はポリシリコン膜を半導体層とする TFT であるので、TFT 30 の形成時に同一薄膜形成工程で、サンプリング回路 201、プリチャージ回路 301、データ線駆動回路 101、走査線駆動回路 104 等の周辺回路を形成できるので製造上有利である。例えば、データ線駆動回路 101 及び走査線駆動回路 104 は、図 4 (3) 及び図 5

(3) に示したプリチャージ回路 201 やサンプリング回路 301 の場合と同様に、N チャネル型 TFT 及び P チャネル型 TFT から構成される相補構造の複数の TFT から TFT アレイ基板 1 上の周辺部分に形成される。

【0098】このように本実施の形態では、TFT 30、202 及び 302 の少なくともチャネル領域下側に遮光層 3 が夫々設けられているので、前述のように戻り光等による悪影響が低減されるため、TFT 30 のトランジスタ特性が改善され、最終的には、液晶装置 200 により、高コントラストで高画質の画像を表示することが可能となる。

【0099】尚、図 6 には示されていないが、対向基板 2 の投射光が入射する側及び TFT アレイ基板 1 の投射光が出射する側には夫々、例えば、TN (ツイステッドネマティック) モード、STN (スーパー TN) モード、D-STN (ダブル STN) モード等の動作モードや、ノーマリーホワイトモード/ノーマリーブラックモードの別に応じて、偏光フィルム、位相差フィルム、偏光手段などが所定の方角で配置される。

【0100】以上説明した液晶装置 200 は、カラー液晶プロジェクトに適用されるため、3 つの液晶装置 200 が RGB 用のライトバルブとして夫々用いられ、各液晶装置には夫々 RGB 色分解用のダイクロイックミラーを介して分解された各色の光が入射光として夫々入射されることになる。従って、各実施の形態では、対向基板 2 に、カラーフィルタは設けられていない。しかしながら、液晶装置 200 においてもブラックマトリクス 23 の形成されていない画素電極 11 に対向する所定領域に RGB のカラーフィルタをその保護膜と共に、対向基板 2 上に形成してもよい。このようにすれば、液晶プロジェクト以外の直視型や反射型のカラー液晶テレビなど

のカラー液晶装置に本実施の形態の液晶装置を適用できる。更に、対向基板 2 上に 1 画素 1 個に対応するようにマイクロレンズを形成してもよい。このようにすれば、入射光の集光効率を向上することで、明るい液晶装置が実現できる。更にまた、対向基板 2 上に、何層もの屈折率の相違する干渉層を堆積することで、光の干渉を利用して、RGB 色を作り出すダイクロイックフィルタを形成してもよい。このダイクロイックフィルタ付き対向基板によれば、より明るいカラー液晶装置が実現できる。

10 【0101】液晶装置 200 では、従来と同様に入射光を対向基板 2 の側から入射することとしたが、遮光層 3 及び 3” が存在するので、TFT アレイ基板 1 の側から入射光を入射し、対向基板 2 の側から出射するようにしても良い。即ち、このように液晶装置 200 を液晶プロジェクトに取り付けても、チャネル形成用の半導体層 32 及び 32” の少なくともチャネル領域に光が入射することを防ぐことが出来、高画質の画像を表示することが可能である。ここで従来は、TFT アレイ基板 1 の裏面側での反射を防止するために、反射防止用の AR 被膜された偏光手段を別途配置したり、AR フィルムを貼り付ける必要があった。しかし、本実施の形態では、TFT アレイ基板 1 の表面と半導体層 32 及び 32” の少なくともチャネル領域との間に遮光層 3 が形成されているため、このような AR 被膜された偏光手段や AR フィルムを用いたり、TFT アレイ基板 1 そのものを AR 処理した基板を使用する必要がなくなる。従って、本実施の形態によれば、材料コストを削減でき、また偏光手段貼り付け時に、ごみ、傷等により、歩留まりを落とすことがなく大変有利である。

30 【0102】また、液晶装置 200 のスイッチング素子は、正スタガ型又はコプラナー型構造の TFT であるとして説明したが、逆スタガ型構造の TFT や他の形式の TFT に対しても、本実施の形態は有効である。

40 【0103】更に、液晶装置 200 においては、一例として液晶層 50 をネマティック液晶から構成したが、液晶を高分子中に微小粒として分散させた高分子分散型液晶を用いれば、配向膜 12 及び 22、並びに前述の偏光フィルム、偏光手段等が不要となり、光利用効率が高まることによる液晶装置の高輝度化や低消費電力化の利点が得られる。更に、画素電極 11 を A1 等の反射率の高い金属膜から構成することにより、液晶装置 200 を反射型液晶装置に適用する場合には、電圧無印加状態で液晶分子がほぼ垂直配向された SH (スーパーホメオトロピック) 型液晶などを用いても良い。更にまた、液晶装置 200 においては、液晶層 50 に対し垂直な電界 (縦電界) を印加するように対向基板 2 の側に共通電極 21 を設けているが、液晶層 50 に平行な電界 (横電界) を印加するように一対の横電界発生用の電極から画素電極 11 を夫々構成する (即ち、対向基板 2 の側には縦電界発生用の電極を設けることなく、TFT アレイ基板 1 の

側に横電界発生用の電極を設ける)ことも可能である。このように横電界を用いると、縦電界を用いた場合よりも視野角を広げる上で有利である。その他、各種の液晶材料(液晶相)、動作モード、液晶配列、駆動方法等に本実施の形態を適用することが可能である。

【0104】(検査回路の動作)以上説明した実施の形態では、プリチャージ回路201及びサンプリング回路301を設けるようにしたが、これらに代えて又は加えて周辺見切り53下に、製造途中や出荷時の当該液晶装置の品質、欠陥等を検査するための所定の検査を行うためのTFTを有する検査回路を設けてもよい。図9に、このような検査回路の一例を示す。

【0105】図9において、検査回路401は、複数のTFT402を備えている。TFT402のゲートには、検査回路駆動信号TX1及びTX2を夫々供給するための駆動信号線403a及び403bが接続されている。TFT402のソースには、検査信号CX1～CX4を夫々供給するための検査信号線404a～404dが接続されている。そして、TFT402のドレインには、データ線35が接続されている。検査の際には、検査回路駆動信号TX1及びTX2によりTFT402が、選択的にオンオフされ、所定電圧の検査信号CX1～CX4、所定電圧のプリチャージ信号及び所定電圧の画像信号が印加される。そして、検査信号線404a～404dに流れる電流値が測定され、予め経験的又は理論的に得られた無欠陥品における電流値と比較される。この結果、所定種類の組み合わせでこれらの印加電圧を印加して電流を測定することにより、例えば配線間における断線の検査、配線間におけるショート(短絡)の検査、プリチャージ回路201やサンプリング回路301における回路リークの検査等を比較的簡単に行うことができる。

【0106】このように、検査回路を設ける場合にも、検査回路が有するTFTの少なくともチャンネル領域下に遮光層3を設け、且つ検査回路を遮光層3と周辺見切り53との間に設けるようにすれば、両基板側からの光に対する遮光がなされているため、光によりトランジスタ特性が劣化することはない。従って、通常に画面を表示する際には使用しない検査回路からのリーク電流により画質品位が著しく低下することはない。これに加えて、走査線駆動回路104やデータ線駆動回路101をTFTアレイ基板1の周辺部分に余裕を持って形成することができ、液晶装置における有効表示面積の減少を招くこともない。尚、図9のような検査回路を設ける代わりに、図9のような検査回路の機能を兼ね備えた検査回路兼用のプリチャージ回路を設けるようにしてもよい。

【0107】更に、プリチャージ回路201及びサンプリング回路301に代えて又は加えて周辺見切り53下に、図8に示すように当該液晶装置を動作させるための、データ線駆動回路101や走査線駆動回路104等

の電圧保持用のTFTを有する周辺回路を設けてもよい。これらの周辺回路はその全て、或いは一部が周辺見切り53に重なるように形成する。このような構成を採れば、シール領域は周辺回路の外側、すなわちTFTアレイ基板1の最外周に設けるようにすれば、周辺回路領域を拡大することができる。この場合も、周辺回路が有するTFTの少なくともチャンネル領域下に遮光層3を設けるようにする。このように周辺回路を遮光層3と周辺見切り53との間に設ければ、両基板側からの光に対する遮光がなされているため、光によりトランジスタ特性が劣化すること(例えば、保持電圧がリークしてしまうこと)はない。特に、このような周辺回路を交流駆動の回路とすれば、周辺見切り53下に配置しても、前述の直流電圧印加による液晶層50の劣化という問題は生じない。

【0108】また、データ線駆動回路101及び走査線駆動回路104をTFTアレイ基板1の上に設ける代わりに、例えばTAB(テープオートメイテッドボンディング基板)上に実装された駆動用LSIに、TFTアレイ基板1の周辺部に設けられた異方性導電フィルムを介して電氣的及び機械的に接続するようにしてもよい。

【0109】(製造プロセス)次に、プリチャージ回路201及びサンプリング回路301を含む液晶装置200の製造プロセスについて図10から図12を参照して説明する。

【0110】まず、遮光層3がTFTアレイ基板1側に設けられたTFT30部分の形成について図10及び図11を参照して説明する。

【0111】図10の工程(1)に示すように、石英基板、ハードガラス、シリコン基板等のTFTアレイ基板1を用意する。ここで、好ましくはN₂(窒素)等の不活性ガス雰囲気且つ約900～1300℃の高温でアニール処理し、後に実施される高温プロセスにおけるTFTアレイ基板1に生じる歪みが少なくなるように前処理しておく。即ち、製造プロセスにおける最高温で高温処理される温度に合わせて、事前にTFTアレイ基板1を同じ温度かそれ以上の温度で熱処理しておく。

【0112】このように処理されたTFTアレイ基板1の全面に、スパッタリング等により、Ti、Cr、W、Ta、Mo及びPd等の少なくとも一つを含む金属、或いは金属シリサイド等の金属合金から成り、1000～5000Å程度の層厚の遮光膜を形成する。続いて、該形成された遮光膜上にフォトリソグラフィにより遮光層3のパターンに対応するマスクを形成し、該マスクを介して遮光膜に対しエッチングを行うことにより、遮光層3を形成する。

【0113】尚、遮光層3は、少なくともTFT30の半導体層32のうちチャンネル形成用の領域、ソース領域34及びドレイン領域36をTFTアレイ基板1の裏面から見て覆うように形成される。

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【0114】次に図10の工程(2)に示すように、遮光層3の上に、例えば、常圧又は減圧CVD法等によりTEOS(テトラ・エチル・オルソ・シリケート)ガス、TEB(テトラ・エチル・ボートレート)ガス、TMOP(テトラ・メチル・オキシ・フォスレート)ガス等を用いて、NSG、PSG、BSG、BPSGなどのシリケートガラス膜、窒化シリコン膜や酸化シリコン膜等からなる第1層間絶縁層41を形成する。第1層間絶縁層41の層厚は、約500~15000Åが好ましい。或いは、熱酸化膜を形成した後、更に減圧CVD法等により高温酸化シリコン膜(HTO膜)や窒化シリコン膜を約500Åの比較的薄い厚さに堆積し、厚さ約2000Åの多層構造を持つ第1層間絶縁層41を形成してもよい。更に、このようなシリケートガラス膜に重ねて又は代えて、SOG(スピノンガラス：紡糸状ガラス)をスピノコートして又はCMP(Chemical Mechanical Polishing)処理を施すことにより、平坦な膜を形成してもよい。このように、第1層間絶縁層41の上面をスピノコート処理又はCMP処理により平坦化しておけば、後に上側にTFT30を形成し易いという利点が得られる。

【0115】尚、第1層間絶縁層41に対し、約900℃のアニール処理を施すことにより、汚染を防ぐと共に平坦化してもよい。

【0116】次に図10の工程(3)に示すように、第1層間絶縁層41の上に、約450~550℃、好ましくは約500℃の比較的低温環境中で、流量約400~600cc/minのモノシランガス、ジシランガス等を用いた減圧CVD(例えば、圧力約20~40PaのCVD)により、アモルファスシリコン膜を形成する。その後、窒素雰囲気中で、約600~700℃にて約1~10時間、好ましくは、4~6時間のアニール処理を施することにより、ポリシリコン膜を約500~2000Åの厚さ、好ましくは約1000Åの厚さとなるまで固相成長させる。この際、Nチャネル型のTFTを作成する場合には、Sb(アンチモン)、As(砒素)、P(リン)などのV族元素のドーパントを僅かにイオン注入等によりドーピングしても良い。また、TFTをPチャネル型とする場合には、Al(アルミニウム)、B(ボロン)、Ga(ガリウム)、In(インジウム)などのII族元素のドーパントを僅かにイオン注入等によりドーピングする。尚、アモルファスシリコン膜を経ないで、減圧CVD法等によりポリシリコン膜を直接形成しても良い。或いは、減圧CVD法等により堆積したポリシリコン膜にシリコンイオンを打ち込んで一旦非晶質化(アモルファス化)し、その後アニール処理等により再結晶化させてポリシリコン膜を形成しても良い。

【0117】次に図10の工程(4)に示すように、半導体層32を約900~1300℃の温度、好ましくは約1000℃の温度により熱酸化することにより、約3

00Åの比較的薄い厚さの熱酸化膜を形成し、更に減圧CVD法等により高温酸化シリコン膜(HTO膜)や窒化シリコン膜を約500Åの比較的薄い厚さに堆積し、多層構造を持つゲート絶縁層33を形成する。この結果、半導体層32の厚さは、約300~1500Åの厚さ、好ましくは約350~450Åの厚さとなり、ゲート絶縁層33の厚さは、約200~1500Åの厚さ、好ましくは約300Åの厚さとなる。このように高温酸化時間を短くすることにより、特に8インチ程度の大基板を使用する場合に熱によるそりを防止することができる。但し、半導体層32を熱酸化することのみにより、単一層構造を持つゲート絶縁層33を形成してもよい。

【0118】次に図10の工程(5)に示すように、半導体層32上にゲート絶縁層33を介して、減圧CVD法等によりポリシリコン膜を堆積した後、フォトリソグラフィ工程、エッチング工程等により、ゲート電極31(走査線)を形成する。

【0119】但し、ゲート電極31(走査線)を、ポリシリコン膜ではなく、高融点金属膜又は金属シリサイド膜とp-Si膜を組み合わせて多層に形成してもよい。この場合、ゲート電極31(走査線)を、第2遮光層23が覆う領域の一部又は全部に対応する遮光膜として配置すれば、金属膜や金属シリサイド膜の持つ遮光性により、第2遮光層23の一部又は全部を省略することも可能となる。この場合特に、対向基板2とTFTアレイ基板1との貼り合わせずれによる画素開口率の低下を防ぐことが出来る利点がある。

【0120】次に図11の工程(6)に示すように、TFT30をLDD構造を持つNチャネル型のTFTとする場合、半導体層32に、先ずソース領域34及びドレイン領域36のうちチャネル側に夫々隣接する一部を構成する低濃度ドーピング領域を形成するために、ゲート電極31を拡散マスクとして、PなどのV族元素のドーパントを低濃度で(例えば、Pイオンを $1\sim 3\times 10^{13}/\text{cm}^2$ のドーピング量にて)ドーピングし、続いて、ゲート電極31よりも幅の広いマスクでレジスト層をゲート電極31上に形成した後、同じくPなどのV族元素のドーパントを高濃度で(例えば、Pイオンを $1\sim 3\times 10^{15}/\text{cm}^2$ のドーピング量にて)ドーピングする。また、TFT30をPチャネル型とする場合、半導体層32に、ソース領域34及びドレイン領域36を形成するために、BなどのII族元素のドーパントを用いてドーピングする。このようにLDD構造とした場合、ショートチャネル効果を低減できる利点が得られる。尚、このように低濃度と高濃度の2段階に分けて、ドーピングを行わなくても良い。例えば、低濃度のドーピングを行わずに、オフセット構造のTFTとしてもよく、ゲート電極31をマスクとして、Pイオン、Bイオン等を用いたイオン注入技術によりセルフアライン型のTFTとしてもよい。

【0121】これらの工程と並行して、Nチャネル型TFT及びPチャネル型TFTから構成される相補型構造を持つデータ線駆動回路101及び走査線駆動回路104をTFTアレイ基板1上の周辺部に形成する。このように、TFT30はポリシリコンTFTであるので、TFT30の形成時に同一工程で、データ線駆動回路101及び走査線駆動回路104を形成することができ、製造上有利である。

【0122】次に図11の工程(7)に示すように、ゲート電極31(走査線)を覆うように、例えば、常圧又は減圧CVD法やTEOSガス等を用いて、NSG、PSG、BSG、BPSGなどのシリケートガラス膜、窒化シリコン膜や酸化シリコン膜等からなる第2層間絶縁層42を形成する。第2層間絶縁層42の層厚は、約5000~15000Åが好ましい。そして、ソース領域34及びドレイン領域36を活性化するために約1000℃のアニール処理を20分程度行った後、ソース電極35(データ線)に対するコンタクトホール37を、反応性エッチング、反応性イオンビームエッチング等のドライエッチングにより形成する。この際、反応性エッチング、反応性イオンビームエッチングのような異方性エッチングにより、コンタクトホール37を開孔した方が、開孔形状をマスク形状とほぼ同じにできるという利点がある。但し、ドライエッチングとウェットエッチングとを組み合わせると開孔すれば、コンタクトホール37をテーパー状にできるので、配線接続時の断線を防止できるという利点が得られる。また、ゲート電極31(走査線)を図示しない配線と接続するためのコンタクトホールも、コンタクトホール37と同一の工程により第2層間絶縁層42に開ける。

【0123】次に図11の工程(8)に示すように、第2層間絶縁層42の上に、スパッタリング処理等により、A1等の低抵抗金属や金属シリサイド等を、約1000~5000Åの厚さに堆積し、更にフォトリソグラフィ工程、エッチング工程等により、ソース電極35(データ線)を形成する。

【0124】この場合、ソース電極35(データ線)を、第2遮光層23が覆う領域の一部又は全部に対応する遮光膜として配置すれば、A1等の金属膜や金属シリサイド膜の持つ遮光性により、第2遮光層23の一部又は全部を省略することも可能となる。この場合特に、対向基板2とTFTアレイ基板1との貼り合わせずれによる画素開口率の低下を防ぐことが出来る利点がある。また、少なくとも半導体層32のチャネル領域を覆うようにソース電極35を形成し、更に、半導体層32のチャネル領域下方に配設された遮光層3の表面に入射光が直接照射されないようにソース電極35で覆うようにする。これにより、入射光及び戻り光から半導体層32のチャネル領域を保護できることから、ポリシリコン膜の光電変換効果によるTFTのリーク電流を低減できる。

【0125】次に図11の工程(9)に示すように、ソース電極35(データ線)上を覆うように、例えば、常圧又は減圧CVD法やTEOSガス等を用いて、NSG、PSG、BSG、BPSGなどのシリケートガラス膜、窒化シリコン膜や酸化シリコン膜等からなる第3層間絶縁層43を形成する。第3層間絶縁層43の層厚は、約5000~15000Åが好ましい。或いは、このようなシリケートガラス膜に代えて又は重ねて、有機膜やSOG(スピノンガラス)をスピノコートして、若しくは又はCMP処理を施して、平坦な膜を形成してもよい。

【0126】更に、画素電極11とドレイン領域36とを電気的接続するためのコンタクトホール38を、反応性エッチング、反応性イオンビームエッチング等のドライエッチングにより形成する。この際、反応性エッチング、反応性イオンビームエッチングのような異方性エッチングにより、コンタクトホール38を開孔した方が、開孔形状をマスク形状とほぼ同じにできるという利点が得られる。但し、ドライエッチングとウェットエッチングとを組み合わせると開孔すれば、コンタクトホール38をテーパー状にできるので、配線接続時の断線を防止できるという利点が得られる。

【0127】次に図11の工程(10)に示すように、第3層間絶縁層43の上に、スパッタリング処理等により、ITO膜等の透明導電性薄膜を、約500~2000Åの厚さに堆積し、更にフォトリソグラフィ工程、エッチング工程等により、画素電極11を形成する。尚、当該液晶装置200を反射型の液晶装置に用いる場合には、A1等の反射率の高い不透明な材料から画素電極11を形成してもよい。

【0128】続いて、画素電極11の上にポリイミド系の配向膜の塗布液を塗布した後、所定のプレティルト角を持つように且つ所定方向でラビング処理を施すこと等により、図1に示した配向膜12が形成される。

【0129】次に、遮光層3がTFTアレイ基板1側に設けられたプリチャージ回路201のTFT202部分の形成について図8のB-B'断面図に基づいて図12を参照して説明する。

【0130】プリチャージ回路201のTFT202部分の形成については、図10及び図11を参照して説明したTFT30部分の形成と図10の工程(1)から図11の工程(6)までは、同一の薄膜形成工程で行われる。従って、その説明は省略する。

【0131】この場合、第2層間絶縁層42にアニール処理を施すまでは図11の工程(7)と同様であるが、その後、図12の工程(7)に示すように、プリチャージ信号線204に対するコンタクトホール37と共にデータ線35に対するコンタクトホール38を、図11の工程(7)と並行して、反応性エッチング、反応性イオンビームエッチング等のドライエッチングにより形

成する。

【0132】次に図12の工程(8)に示すように、図11の工程(8)と同一の薄膜形成工程により、第2層間絶縁層42の上に、スパッタリング処理等により、A1等の低抵抗金属や金属シリサイド等を堆積する。更に図11の工程(8)と並行して、フォトリソグラフィ工程、エッチング工程等により、所定パターンを夫々持つプリチャージ信号線204及びデータ線35を形成する。

【0133】次に図12の工程(9)に示すように、図11の工程(9)と同一の薄膜形成工程により、データ線35及びプリチャージ信号線204上を覆うようにシリケートガラス等からなる第3層間絶縁層43を形成する。そして、図11の工程(10)の薄膜形成工程により、第3層間絶縁層43の上に堆積されるITO膜等の透明導電性薄膜については、エッチング処理等により全て除去する。

【0134】尚、遮光層3”がTFTアレイ基板1側に設けられたサンプリング回路301のTFT302部分の形成については上述のプリチャージ回路201のTFT202部分の形成と同様であるので、その説明は省略する。

【0135】(電子機器)次に、以上詳細に説明した液晶装置200を備えた電子機器の実施の形態について図13から図18を参照して説明する。

【0136】先ず図13に、このように液晶装置200を備えた電子機器の概略構成を示す。

【0137】図13において、電子機器は、表示情報出力源1000、表示情報処理回路1002、前述の走査線駆動回路104及びデータ線駆動回路101を含む駆動回路1004、前述のように構成されたプリチャージ回路及びサンプリング回路が設けられた液晶装置200、クロック発生回路1008並びに電源回路1010を備えて構成されている。表示情報出力源1000は、ROM(Read Only Memory)、RAM(Random Access Memory)、光ディスク装置などのメモリ、同調回路等を含み、クロック発生回路1008からのクロック信号に基づいて、所定フォーマットの画像信号などの表示情報を表示情報処理回路1002に出力する。表示情報処理回路1002は、増幅・極性反転回路、相展開回路、ローテーション回路、ガンマ補正回路、クランプ回路等の周知の各種処理回路を含んで構成されており、クロック信号に基づいて入力された表示情報からデジタル信号を順次生成し、クロック信号CLKと共に駆動回路1004に出力する。駆動回路1004は、走査線駆動回路104及びデータ線駆動回路101によって前述の駆動方法により液晶装置200を駆動する。電源回路1010は、上述の各回路に所定電源を供給する。尚、液晶装置200を構成するTFTアレイ基板の上に、駆動回路1004を搭載してもよく、これに加えて表示情報処

理回路1002を搭載してもよい。

【0138】次に図14から図18に、このように構成された電子機器の具体例を夫々示す。

【0139】図14には、液晶プロジェクタ1100は、上述した駆動回路1004がTFTアレイ基板上に搭載された液晶装置を含む液晶モジュールを3個用意し、夫々RGB用の液晶装置962R、962G及び962Bとして用いた投射型プロジェクタの光学系の概略構成図を示し、図15は、図14のE-E'断面図である。本例の投射型表示装置の光学系には、前述した光源装置920と、均一照明光学系923が採用されている。そして、投射型表示装置は、この均一照明光学系923から出射される光束Wを赤(R)、緑(G)、青(B)に分離する色分離手段としての色分離光学系924と、各色光束R、G、Bを変調する変調手段としての3つのライトバルブ925R、925G、925Bと、変調された後の色光束を再合成する色合成手段としての色合成プリズム910と、合成された光束を投射面100の表面に拡大投射する投射手段としての投射レンズユニット6を備えている。また、青色光束Bに対応するライトバルブ925Bに導く導光系927をも備えている。

【0140】均一照明光学系923は、2つのレンズ板921、922と反射ミラー931を備えており、反射ミラー931を挟んで2つのレンズ板921、922が直交する状態に配置されている。均一照明光学系923の2つのレンズ板921、922は、それぞれマトリクス状に配置された複数の矩形レンズを備えている。光源装置920から出射された光束は、第1のレンズ板921の矩形レンズによって複数の部分光束に分割される。そして、これらの部分光束は、第2のレンズ板922の矩形レンズによって3つのライトバルブ925R、925G、925B付近で重畳される。従って、均一照明光学系923を用いることにより、光源装置920が出射光束の断面内で不均一な照度分布を有している場合でも、3つのライトバルブ925R、925G、925Bを均一な照明光で照明することが可能となる。

【0141】各色分離光学系924は、青緑反射ダイクロイックミラー941と、緑反射ダイクロイックミラー942と、反射ミラー943から構成される。まず、青緑反射ダイクロイックミラー941において、光束Wに含まれている青色光束Bおよび緑色光束Gが直角に反射され、緑反射ダイクロイックミラー942の側に向かう。赤色光束Rはこのミラー941を通過して、後方の反射ミラー943で直角に反射されて、赤色光束Rの出射部944からプリズムユニット910の側に射出される。

【0142】次に、緑反射ダイクロイックミラー942において、青緑反射ダイクロイックミラー941において反射された青色、緑色光束B、Gのうち、緑色光束G

のみが直角に反射されて、緑色光束Gの出射部945から色合成光学系の側に出射される。緑反射ダイクロイックミラー942を通過した青色光束Bは、青色光束Bの出射部946から導光系927の側に出射される。本例では、均一照明光学素子の光束Wの出射部から、色分離光学系924における各色光束の出射部944、945、946までの距離がほぼ等しくなるように設定されている。

【0143】色分離光学系924の赤色、緑色光束R、Gの出射部944、945の出射側には、それぞれ集光レンズ951、952が配置されている。したがって、各出射部から出射した赤色、緑色光束R、Gは、これらの集光レンズ951、952に入射して平行化される。

【0144】このように平行化された赤色、緑色光束R、Gは、ライトバルブ925R、925Gに入射して変調され、各色光に対応した画像情報が付加される。すなわち、これらの液晶装置は、不図示の駆動手段によって画像情報に応じてスイッチング制御されて、これにより、ここを通過する各色光の変調が行われる。このような駆動手段は公知の手段をそのまま使用することができる。一方、青色光束Bは、導光系927を介して対応するライトバルブ925Bに導かれ、ここにおいて、同様に画像情報に応じて変調が施される。尚、本例のライトバルブ925R、925G、925Bは、それぞれさらに入射側偏光手段960R、960G、960Bと、出射側偏光手段961R、961G、961Bと、これらの間に配置された液晶装置962R、962G、962Bとからなる液晶ライトバルブである。

【0145】導光系927は、青色光束Bの出射部946の出射側に配置した集光レンズ954と、入射側反射ミラー971と、出射側反射ミラー972と、これらの反射ミラーの間に配置した中間レンズ973と、ライトバルブ925Bの手前側に配置した集光レンズ953とから構成されている。集光レンズ946から出射された青色光束Bは、導光系927を介して液晶装置962Bに導かれて変調される。各色光束の光路長、すなわち、光束Wの出射部から各液晶装置962R、962G、962Bまでの距離は青色光束Bが最も長くなり、したがって、青色光束の光量損失が最も多くなる。しかし、導光系927を介在させることにより、光量損失を抑制することができる。

【0146】各ライトバルブ925R、925G、925Bを通して変調された各色光束R、G、Bは、色合成プリズム910に入射され、ここで合成される。そして、この色合成プリズム910によって合成された光が投射レンズユニット906を介して所定の位置にある投射面100の表面に拡大投射されるようになっている。

【0147】本実施の形態では、液晶装置962R、962G、962Bには、TFTの下側に遮光層が設けられているため、当該液晶装置962R、962G、96

2Bからの投射光に基づく液晶プロジェクタ内の投射光学系による反射光、投射光が通過する際のTFTアレイ基板の表面からの反射光、他の液晶装置から出射した後に投射光学系を突き抜けてくる投射光の一部等が、戻り光としてTFTアレイ基板の側から入射しても、画素電極のスイッチング用のTFT、あるいはサンプリング回路のTFT、プリチャージング回路のTFT、検査回路のTFT、或いはデータ線駆動回路や走査線駆動回路等の周辺回路等のチャンネルに対する遮光を十分に行うことができる。

【0148】このため、小型化に適したプリズムユニットを投射光学系に用いても、各液晶装置962R、962G、962Bとプリズムユニットとの間において、戻り光防止用のフィルムを別途配置したり、偏光手段に戻り光防止処理を施したりすることが不要となるので、構成を小型且つ簡易化する上で大変有利である。

【0149】また、本実施の形態では、戻り光によるTFTのチャンネル領域への影響を抑えることができるため、液晶装置に直接戻り光防止処理を施した偏光手段を貼り付けなくてもよい。そこで、図14及び図15に示されるように、偏光手段を液晶装置から離して形成、より具体的には、一方の偏光手段961R、961G、961Bはプリズムユニット910に貼り付け、他方の偏光手段960R、960G、960Bは集光レンズ953、945、944に貼り付けることが可能である。このように、偏光手段をプリズムユニットに貼り付けることにより、偏光手段の熱は、プリズムユニットで吸収されるため、液晶装置の温度上昇を防止することができる。

【0150】また、図15に示されるように、液晶装置と偏光手段と間を離して形成することにより、液晶装置と偏光手段との間には空気層ができるため、例えばプリズムユニットの上側あるいは下側の一方に冷却手段を設け、冷却手段から液晶装置と偏光手段との間に冷風等の送風を送風口990から送り込むことにより、液晶装置の温度上昇をさらに防ぐことができ、液晶装置の温度上昇による誤動作を防ぐことができる。

【0151】図16において、電子機器の他の例たるラップトップ型のパーソナルコンピュータ1200は、上述した液晶装置200がトップカバーケース内に備えられており、更にCPU、メモリ、モデム等を収容すると共にキーボード1202が組み込まれた本体1204を備えている。

【0152】図17において、電子機器の他の例たるページャ1300は、金属フレーム1302内に前述の駆動回路1004がTFTアレイ基板上に搭載されて液晶モジュールをなす液晶装置200が、バックライト1306aを含むライトガイド1306、回路基板1308、第1及び第2のシールド板1310及び1312、二つの弾性導電体1314及び1316、並びにフィル

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ムキャリアテープ1318と共に収容されている。この例の場合、前述の表示情報処理回路1002（図13参照）は、回路基板1308に搭載してもよく、液晶装置200のTFTアレイ基板上に搭載してもよい。更に、前述の駆動回路1004を回路基板1308上に搭載することも可能である。

【0153】また図18に示すように、駆動回路1004や表示情報処理回路1002を搭載しない液晶装置200の場合には、駆動回路1004や表示情報処理回路1002を含むIC1324がポリイミドテープ1322上に実装されたTCP（Tape Carrier Package）1320に、TFTアレイ基板1の周辺部に設けられた異方性導電フィルムを介して物理的且つ電氣的に接続して、液晶装置として、生産、販売、使用等することも可能である。

【0154】以上図14から図18を参照して説明した電子機器の他にも、液晶テレビ、ビューファインダ型又はモニタ直視型のビデオテーブルコード、カーナビゲーション装置、電子手帳、電卓、ワードプロセッサ、ワークステーション、携帯電話、テレビ電話、POS端末、タッチパネルを備えた装置等などが図13に示した電子機器の例として挙げられる。

【0155】以上説明したように、本実施の形態によれば、戻り光等に対する遮光性能が高く、優れたトランジスタ特性を持つTFTにより、高品位の画像表示が可能な液晶装置を備えた各種の電子機器を実現できる。

【0156】

【発明の効果】本発明によれば、例えばTFT等からなる第1、第2及び第3スイッチング素子において戻り光等に起因して光電流が発生してスイッチング特性が劣化する事態は未然に防止されるので、優れたスイッチング特性を持つスイッチング素子により、高品位の画像表示が可能となる。更にサンプリング回路やプリチャージ回路を従来のように遮光性のケースに入れられた第1基板の周辺部分に配置する必要はないので、例えば、これらの回路を周辺見切り下に配置することにより、周辺見切りの下というデッドスペースを有効利用することも可能となる。

【0157】また、戻り光等に起因して半導体層に光電流が発生してTFTのトランジスタ特性が劣化する事態は未然に防止されるので、優れたトランジスタ特性を持つTFTにより、高品位の画像表示が可能となる。

【図面の簡単な説明】

【図1】 液晶装置の実施の形態におけるTFTアレイ基板上に形成された各種配線、周辺回路等のブロック図である。

【図2】 図1の液晶装置の全体構成を示す平面図である。

【図3】 図1の液晶装置の全体構成を示す断面図である。

【図4】 液晶装置に設けられたプリチャージ回路を構成するTFTの回路図である。

【図5】 液晶装置に設けられたサンプリング回路を構成するTFTの回路図である。

【図6】 液晶装置を構成する画素スイッチング用TFT及びプリチャージ回路用TFTを示す断面図である。

【図7】 図6の液晶装置のTFTアレイ基板の画面表示領域のコーナー部を示す平面図である。

【図8】 図1の液晶装置の実施の形態におけるTFTアレイ基板上に形成された各種配線、周辺回路等の応用例のブロック図である。

【図9】 検査回路の一例の回路図である。

【図10】 図6の液晶装置の一部分における製造プロセスを順を追って示す工程図（その1）である。

【図11】 図6の液晶装置の一部分における製造プロセスを順を追って示す工程図（その2）である。

【図12】 図6の液晶装置の他部分における製造プロセスを順を追って示す工程図である。

【図13】 本発明による電子機器の実施の形態の概略構成を示すブロック図である。

【図14】 電子機器の一例としての液晶プロジェクトを示す断面図である。

【図15】 図14のE-E'断面図である。

【図16】 電子機器の他の例としてのパーソナルコンピュータを示す正面図である。

【図17】 電子機器の一例としてのページャを示す分解斜視図である。

【図18】 電子機器の一例としてのTCPを用いた液晶装置を示す斜視図である。

【符号の説明】

1…TFTアレイ基板

2…対向基板

3、3'…遮光層

11…画素電極

12…配向膜

21…共通電極

22…配向膜

23…第2遮光層

30、202、302…TFT

31…走査線（ゲート電極）

32、32'…半導体層

33、33'…ゲート絶縁層

34、34'…ソース領域

35…データ線（ソース電極）

36、36'…ドレイン領域

37、37'、38、38'…コンタクトホール

41…第1層間絶縁層

42…第2層間絶縁層

43…第3層間絶縁層

50 50…液晶層

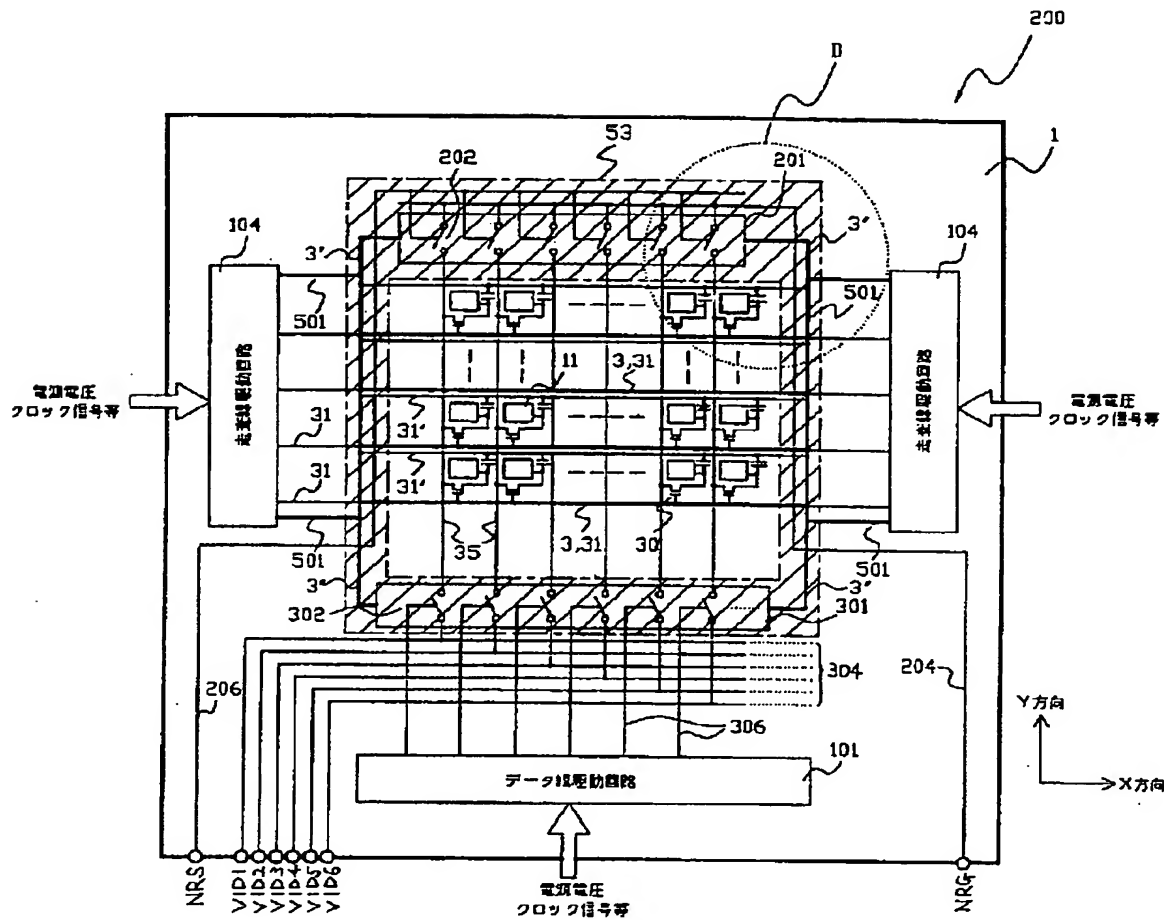
37

38

52...シール材
 53...周辺見切り
 70...蓄積容量
 101...データ線駆動回路
 104...走査線駆動回路
 200...液晶装置
 201...プリチャージ回路

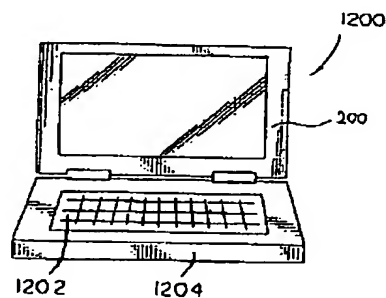
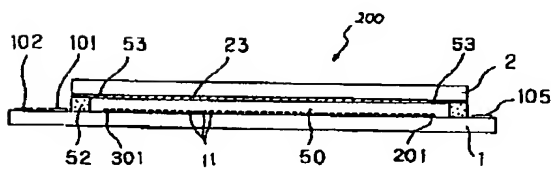
202...TFT
 204...プリチャージ信号線
 206...プリチャージ回路駆動信号線
 301...サンプリング回路
 302...TFT
 401...検査回路
 402...TFT

【図1】

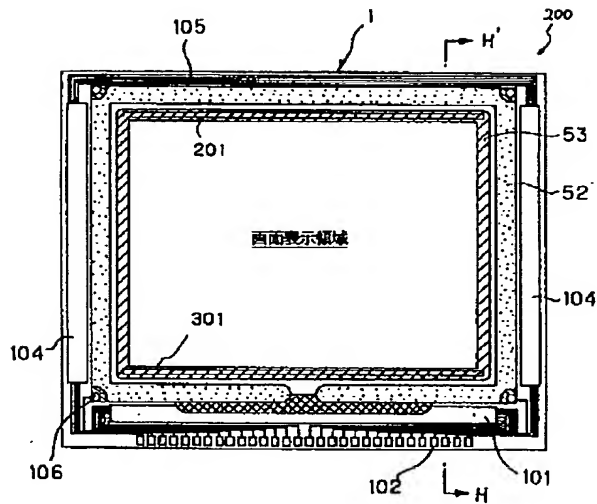


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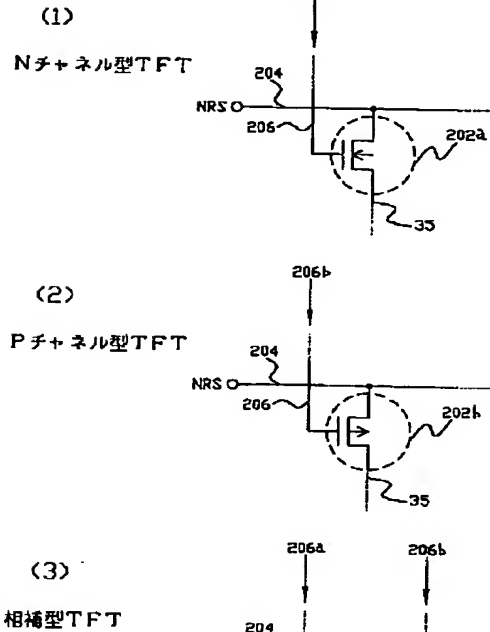
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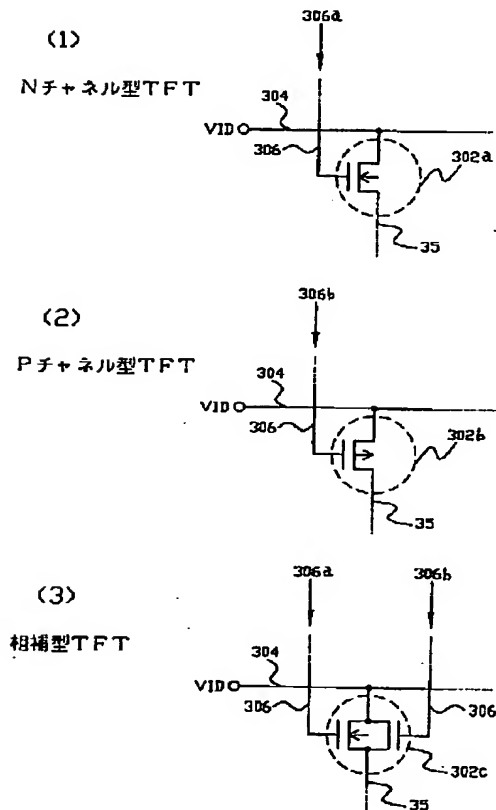
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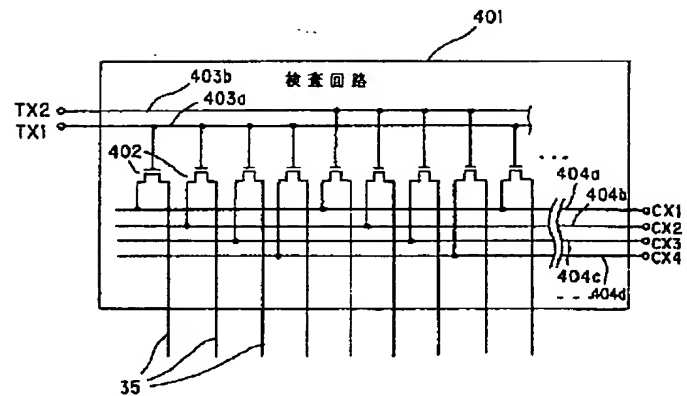
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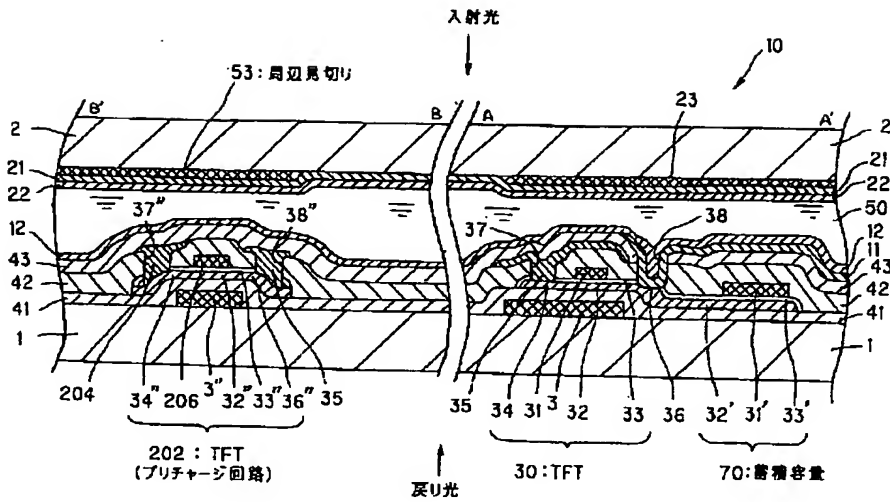
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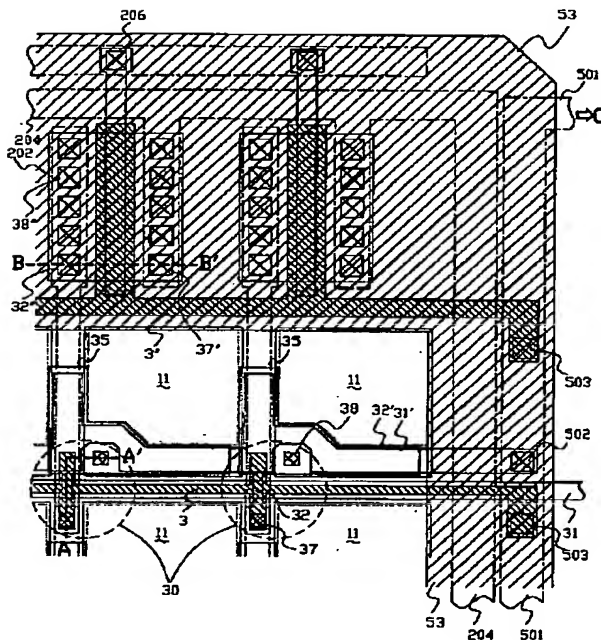
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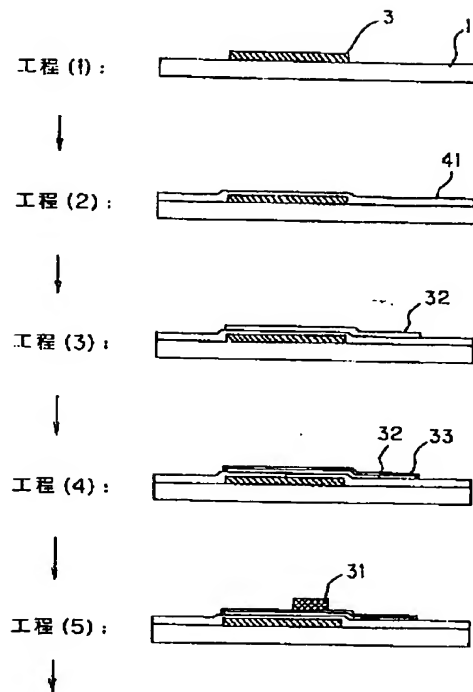
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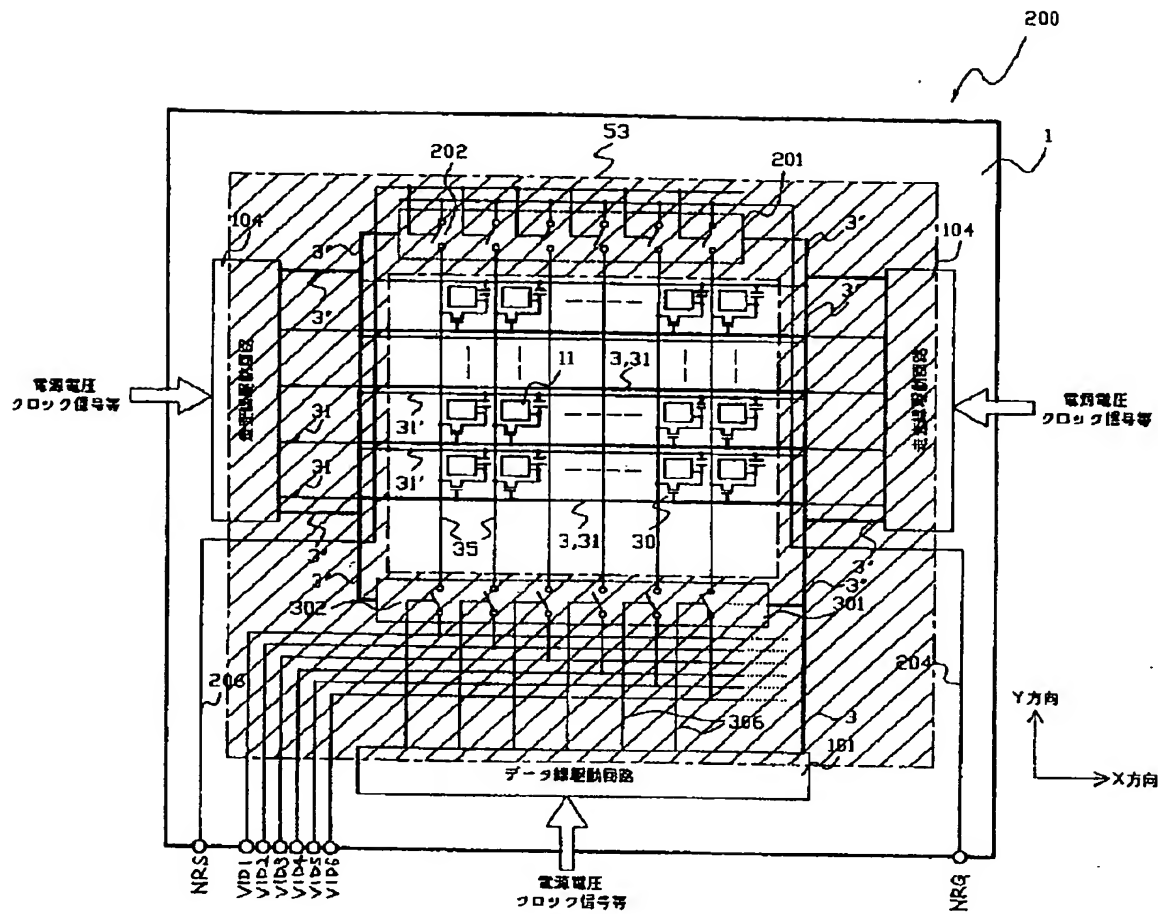
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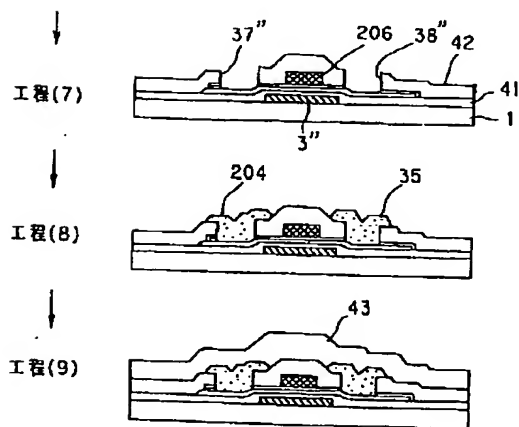
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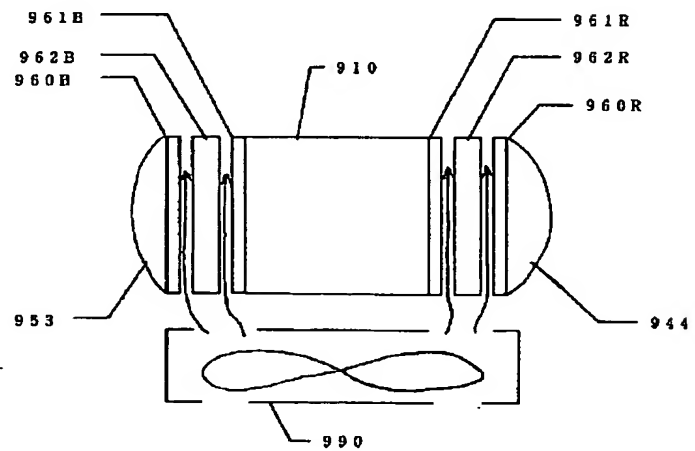
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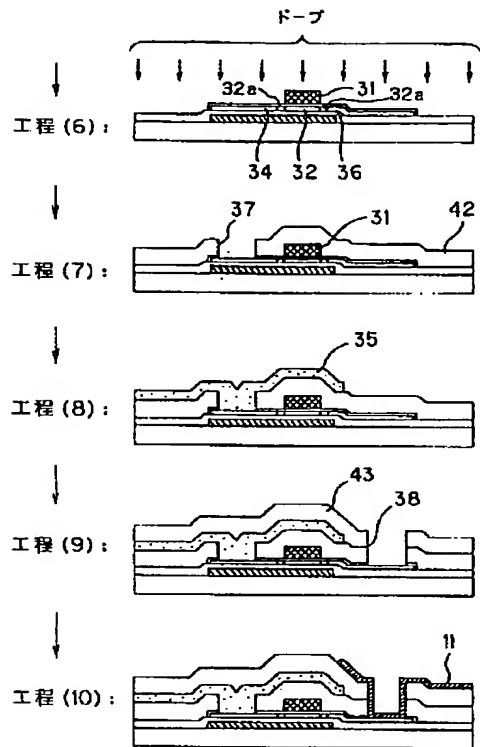
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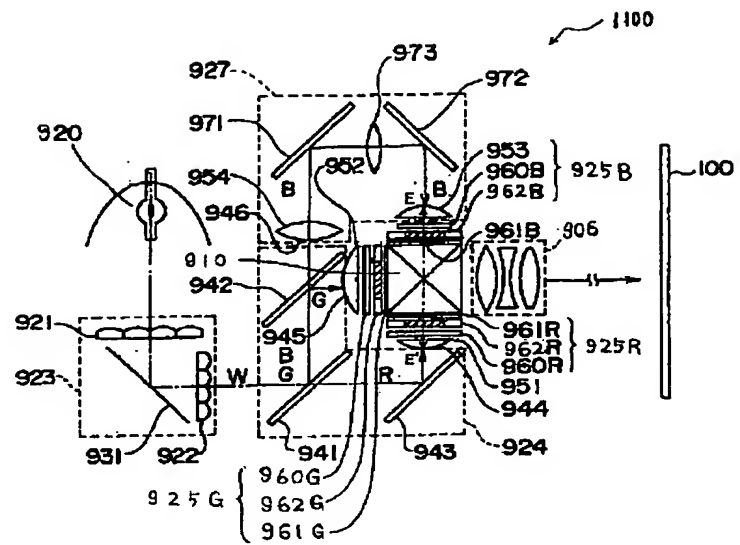
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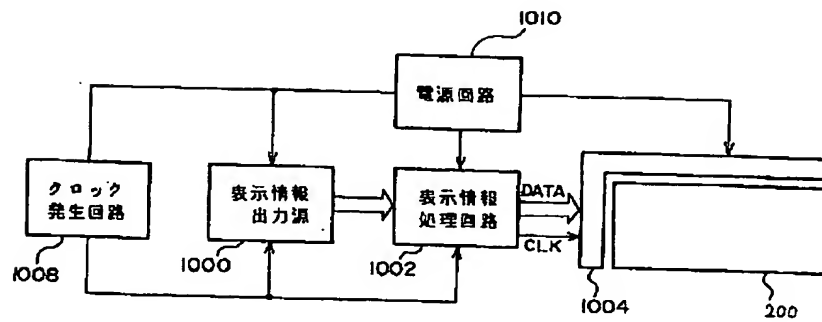
【図11】



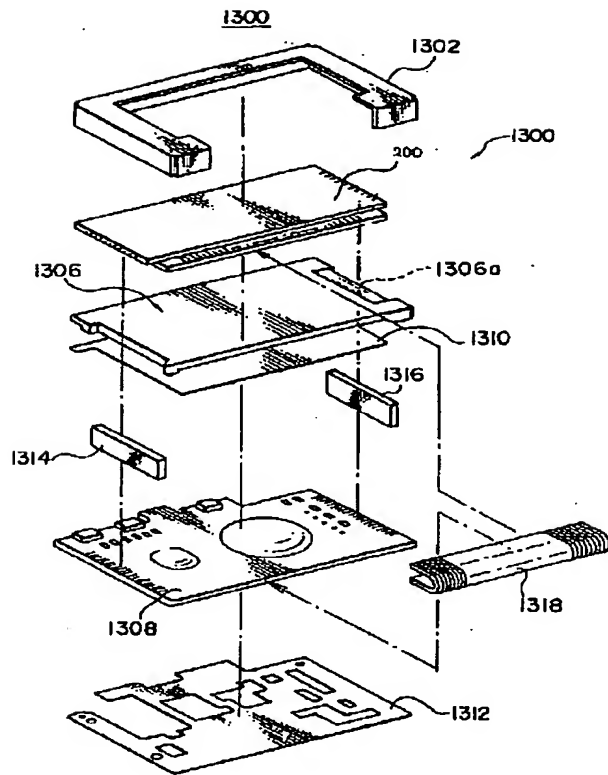
【図14】



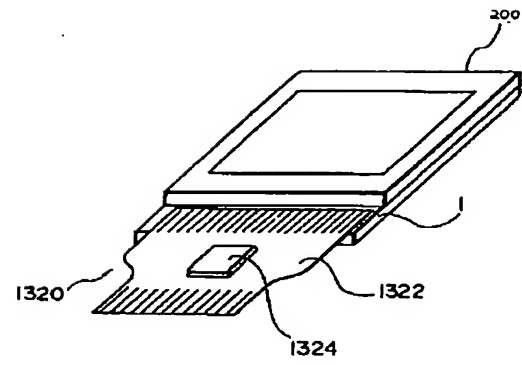
【図13】



【図 17】



【図 18】



PATENT ABSTRACTS OF JAPAN

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INOUE TAKESHI

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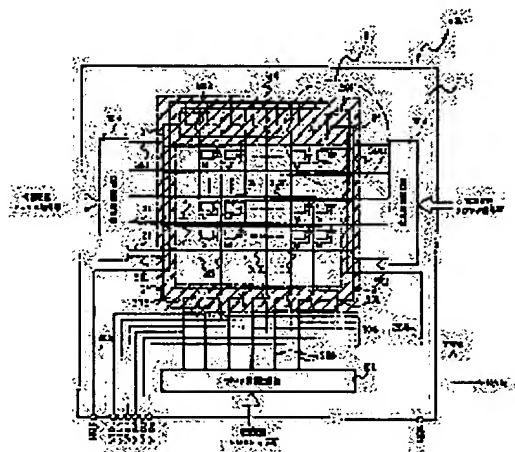
Priority number : 09301250 Priority date : 31.10.1997 Priority country : JP

(54) LIQUID CRYSTAL DEVICE, ELECTRONIC EQUIPMENT, AND PROJECTION DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain image display of high quality by superior switching by improving light shielding against return light, etc., from below TFTs(thin film transistor) of a precharge circuit, a sampling circuit, etc., in an active matrix drive liquid crystal device.

SOLUTION: The liquid crystal device 200 is equipped with a liquid crystal layer sandwiched between a couple of substrates, pixel electrodes 11 which are provided in matrix on the substrate, and TFTs 30 which perform switching control over them. A light shield layer is provided below those TFTs 30 and the TFTs 202 to 302 of the precharge circuit 201 and sampling circuit 301.



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[Patent number]

[Date of registration]

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CLAIMS

[Claim(s)]

[Claim 1] A sampling circuit which is equipped with the following, samples a picture signal by two or more 2nd switching elements, and is supplied to said two or more data lines, One [at least] circuit is arranged at said 1st substrate among precharge circuits which precede a precharge signal of a predetermined voltage level with said picture signal by two or more 3rd switching elements at said two or more data lines, and are supplied, respectively. In a location which counters one [at least] element of said 2nd and 3rd switching elements which one [said / at least] circuit has in said 1st switching element list, respectively Liquid crystal equipment characterized by having further a protection-from-light layer prepared, respectively between said 1st substrate and said 1st switching element, and one [this] element. It comes to pinch liquid crystal between the 1st and 2nd substrates of a pair, and they are two or more scanning lines [top / said / 1st substrate]. Two or more data lines which intersect said two or more scanning lines Two or more 1st switching elements connected to two or more of said scanning lines and data lines Two or more pixel electrodes connected to said two or more 1st switching elements

[Claim 2] At least one of said 1st, 2nd, and 3rd switching elements is liquid crystal equipment according to claim 1 characterized by including a semiconductor layer which constitutes this thin film transistor that consisted of a thin film transistor and was formed through an insulator layer on said protection-from-light layer.

[Claim 3] It is liquid crystal equipment according to claim 1 or 2 which at least one of said 1st, 2nd, and 3rd switching elements consists of a thin film transistor of LDD (Lightly Doped Drain) structure, and is characterized by preparing said protection-from-light layer in a location which counters a channel field and a LDD field of this thin film transistor at least.

[Claim 4] Said protection-from-light layer is liquid crystal equipment given in any 1 term of claims 1-3 characterized by crossing to the whole region and being formed from the same material of the same thin film formation production process.

[Claim 5] Said protection-from-light layer is liquid crystal equipment given in any 1 term of claims 1-4 characterized by connecting with a constant source of potential.

[Claim 6] Constant potential of said constant source of potential is liquid crystal equipment according to claim 5 characterized by being equal to touch-down potential.

[Claim 7] It is liquid crystal equipment according to claim 5 characterized by having further a counterelectrode prepared in a side which meets said liquid crystal of said 2nd substrate, and constant potential of said constant source of potential being equal to potential of said counterelectrode.

[Claim 8] At least one of said 1st, 2nd, and 3rd switching elements is liquid crystal equipment given in any 1 term of claims 1-7 characterized by consisting of a thin film transistor of any one mold in an N channel mold, a P channel mold, and a complementary type.

[Claim 9] A seal member which sticks said 1st and 2nd substrates in the perimeter of a screen-display field specified with said two or more pixel electrodes on a plane parallel to said 1st and 2nd substrates, and surrounds said liquid crystal, It has further circumference abandonment of protection-from-light nature formed along with an outline of said screen-display field at said 2nd substrate between said seal members and said screen-display fields on said plane. One [said / at least] circuit is liquid crystal equipment given in any 1 term of claims 1-8 characterized by being prepared in a location which counters said circumference abandonment.

[Claim 10] It is liquid crystal equipment given in any 1 term of claims 1-9 to which said precharge circuit is prepared, and said two or more data lines are characterized by supplying said precharge signal from the other side while said picture signal is supplied from one side of said data line.

[Claim 11] It is liquid crystal equipment given in any 1 term of claims 1-10 characterized by establishing further an inspection circuit containing the 4th switching element for conducting predetermined inspection to the liquid crystal

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equipment concerned in said 1st substrate, and preparing said protection-from-light layer further between said 1st substrate and said 4th switching element in a location which counters said 4th switching element.

[Claim 12] It is liquid crystal equipment characterized by replacing with one [said / at least] circuit, establishing a circumference circuit containing the 5th switching element for voltage maintenance for operating the liquid crystal equipment concerned in said 1st substrate in liquid crystal equipment according to claim 1, and preparing said protection-from-light layer between said 1st substrate and said 5th switching element in a location which counters said 5th switching element.

[Claim 13] Electronic equipment characterized by equipping claims 1-12 with liquid crystal equipment of a publication.

[Claim 14] The light source A delivery system which projects light modulated with a liquid crystal light valve which incidence of the light by which outgoing radiation is carried out from this light source is carried out, and performs a modulation corresponding to image information, and said liquid crystal light valve It is the projection mold indicating equipment equipped with the above. Said liquid crystal light valve Liquid crystal equipment with which liquid crystal was pinched between the 2nd substrate arranged at a 1st substrate [which has been arranged at an incidence side of light], and outgoing radiation side, It has the 1st polarization means arranged on the outside of said 1st substrate, and the 2nd polarization means arranged on the outside of said 2nd substrate. On said 2nd substrate Two or more scanning lines, two or more data lines which intersect said two or more scanning lines, and two or more 1st thin film transistors connected to two or more of said scanning lines and data lines, It has two or more pixel electrodes connected to said two or more 1st thin film transistors. Between said 2nd substrate and said 1st thin film transistor, it is characterized by thing of said 1st thin film transistor which come to arrange a protection-from-light layer at least corresponding to a channel field, and it comes to form space between said 2nd polarization means and said liquid crystal equipment.

[Claim 15] The light source A color separation means to separate into a colored light bunch of at least 2 colors the flux of light by which outgoing radiation is carried out from this light source A liquid crystal light valve which performs a modulation corresponding to image information to the flux of light of each color separated by said color separation means A synthetic means to compound light modulated with said liquid crystal light valve A delivery system which projects the synthetic flux of light by which outgoing radiation was carried out from said synthetic means It is the projection mold indicating equipment equipped with the above. Said liquid crystal light valve Liquid crystal equipment with which it comes to pinch liquid crystal between the 2nd substrate arranged at a 1st substrate [which has been arranged at an incidence side of light], and outgoing radiation side of light, It has the 1st polarization means arranged on the outside of said 1st substrate, and the 2nd polarization means arranged on the outside of said 2nd substrate. On said 2nd substrate Two or more scanning lines, two or more data lines which intersect said two or more scanning lines, and two or more 1st thin film transistors connected to two or more of said scanning lines and data lines, It has two or more pixel electrodes connected to said two or more 1st thin film transistors. Between said 2nd substrate and said 1st thin film transistor, it is characterized by thing of said 1st thin film transistor for which it comes to arrange a protection-from-light layer at least corresponding to a channel field, and said 2nd polarization means is stuck on said synthetic means.

[Claim 16] A projection mold display according to claim 15 characterized by said synthetic means consisting of a prism unit.

[Claim 17] A projection mold display given in any 1 term of claim 14 characterized by having further a ventilation means for sending a wind between said liquid crystal equipment and said 2nd polarization means thru/or claim 16.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention belongs to the technical field of the electronic equipment using the liquid crystal equipment of a active-matrix drive method and this by thin film transistor (TFT is called suitably below) drive, and belongs to the technical field of the electronic equipment using the liquid crystal equipment of format and this which are especially used for a liquid crystal projector etc. and which prepared the protection-from-light layer in the TFT bottom.

[0002]

[Description of the Prior Art] When this kind of liquid crystal equipment is conventionally used for a liquid crystal projector etc. as a light valve, generally on both sides of a liquid crystal layer, incidence of the incident light is carried out to a TFT array substrate from the opposite substrate side by which opposite arrangement is carried out. Here, if incident light carries out incidence to the field for channel formation which consisted of the amorphous silicon films and polish recon films of TFT, in this field, a photocurrent will occur according to the photo-electric-conversion effect, and the transistor characteristics of TFT will deteriorate. For this reason, it is common to an opposite substrate that a protection-from-light layer is formed in each location which counters TFT, respectively from metallic materials, resin blacks, etc., such as Cr (chromium).

[0003] furthermore, especially in this kind of liquid crystal equipment, to use the amorphous silicon or poly-Si TFT of the positive stagger mold which take top gate structure (namely, structure where the gate electrode be prepared on the TFT array substrate at the channel bottom), or a coplanar mold, a part of incident light need to prevent carry out incidence to the channel of TFT from a TFT array substrate side as a return light by the incident light study system in a liquid crystal projector. Similarly, a part of reflected light from the surface of the TFT array substrate at the time of incident light passing and incident light which runs through an incident light study system after carrying out outgoing radiation from other liquid crystal equipments in the case of using it combining two or more liquid crystal equipments for colors further need to protect carrying out incidence to the channel field of TFT from a TFT array substrate side as a return light. for this reason, the location (namely, under TFT) which counters in JP,9-127497,A, JP,3-52611,B, JP,3-125123,A, and JP,8-171101,A at TFT on the TFT array substrate which consists of a quartz substrate etc. -- for example, the liquid crystal equipment which formed the protection-from-light layer from the opaque refractory metal is proposed.

[0004] On the other hand, in this kind of liquid crystal equipment, various kinds of circumference circuits which use TFT(s), such as a scanning-line drive circuit, a data-line drive circuit, a precharge circuit, a sampling circuit, and an inspection circuit, as a component may be prepared on such a TFT array substrate.

[0005] Among these circumference circuits, a precharge circuit is the timing preceded with the picture signal supplied from a data-line drive circuit to the data line for the purpose of reduction of improvement in a contrast ratio, the stability of the potential level of the data line, and the Rhine unevenness on the display screen etc., and is a circuit which mitigates the load at the time of writing a picture signal in the data line by supplying a precharge signal (image auxiliary signal). In case a picture signal will be written in the data line in the so-called 1H reversal drive method which is reversed a predetermined period and drives the voltage polarity of the data line usually performed if the precharge signal is beforehand written in the data line in order to carry out the alternating current drive especially of the liquid crystal, required quantity of electricity can be lessened notably. For example, an example of such a precharge circuit is indicated by JP,7-295520,A.

[0006] A sampling circuit is a circuit which samples a picture signal, in order to supply the picture signal of high frequency to each data line stably to predetermined timing synchronizing with a scan signal. Moreover, an inspection

circuit is a circuit for inspecting the quality of the liquid crystal equipment at the manufacture middle or the time of shipment, a defect, etc. It is also possible to prepare various kinds of circumference circuits using TFT etc. on a TFT array substrate also out of it from viewpoints, such as improvement in the image quality in a liquid crystal display, reduction of power consumption, and reduction of cost.

[0007] By the way, if direct current voltage is impressed to the liquid crystal by which the closure was carried out into this kind of liquid crystal equipment, causing deterioration of liquid crystal is known. For this reason, generally, carrying out the direct-current drive of the liquid crystal is not performed, but it is made to carry out the alternating current drive of the liquid crystal by carrying out voltage inversion of the picture signal over each pixel the predetermined periods for every field. However, if the above-mentioned circumference circuit is established in the substrate portion which faces liquid crystal, the direct-current-voltage component in a circumference circuit will be impressed to liquid crystal to some extent, and deterioration of liquid crystal will be caused like the case where above-mentioned a direct-current drive is carried out. Therefore, it is not common to establish these circumference circuits in the substrate portion which faces liquid crystal. Moreover, it is not common to establish a circumference circuit in the substrate portion which faces liquid crystal from a viewpoint which reduces a display area relatively. For this reason, these circumference circuits are established in the circumference portion of the TFT array substrate dedicated to the interior of the case of protection-from-light nature which consists of plastics etc. Therefore, to TFT which constitutes these circumference circuits, like TFT which drives the above-mentioned pixel electrode, the protection-from-light layer to incident light is not prepared in an opposite substrate side, or the protection-from-light layer to return light is not prepared in a TFT array substrate side.

[0008]

[Problem(s) to be Solved by the Invention] In liquid crystal equipment, if the size of the liquid crystal module which added the circumference circuit is the same, the screen-display field specified with two or more pixel electrodes arranged in the shape of a matrix, i.e., the field as which an image is actually displayed by change of the orientation condition of liquid crystal on liquid crystal equipment, has the general request of being so good that it being large.

[0009] however -- the configuration which establishes the above-mentioned circumference circuit in the circumference portion of the substrate dedicated to the case of protection-from-light nature -- inevitable -- the width of face of this case portion -- increasing -- the above -- it cannot reply to a general request. On the contrary, when these circumference circuits are established in a narrow long and slender circumference portion by force, there is a trouble that it becomes difficult to design these circumference circuit so that specific specification may be met.

[0010] Moreover, in having established the circumference circuit in the substrate portion which faces the liquid crystal in a screen-display field, incident light will carry out incidence to TFT which constitutes a circumference circuit from an opposite substrate side, or return light will carry out incidence from a TFT array substrate side. For this reason, there is a trouble that a photocurrent will occur and the transistor characteristics of TFT will deteriorate. In addition, in having established the circumference circuit in the substrate portion which faces the liquid crystal in a screen-display field, while causing reduction in a display area, there is also a trouble that the special configuration for preventing impressing direct current voltage to liquid crystal from a circumference circuit is needed.

[0011] The protection-from-light engine performance of this invention to light, such as return light from the switching element bottom, such as TFT which it is made in view of the trouble mentioned above, and circumference circuits, such as a precharge circuit, a sampling circuit, and an inspection circuit, have, is high, and let it be a technical problem to offer the electronic equipment equipped with the liquid crystal equipment in which image display is possible and the liquid crystal equipment concerned of high quality with the outstanding switching characteristic.

[0012]

[Means for Solving the Problem] In order that liquid crystal equipment according to claim 1 may solve the above-mentioned technical problem, it comes to pinch liquid crystal between the 1st and 2nd substrates of a pair. On said 1st substrate Two or more scanning lines, two or more data lines which intersect said two or more scanning lines, and two or more 1st switching elements connected to two or more of said scanning lines and data lines, A sampling circuit which has two or more pixel electrodes connected to said two or more 1st switching elements, samples a picture signal by two or more 2nd switching elements, and is supplied to said two or more data lines, One [at least] circuit is arranged at said 1st substrate among precharge circuits which precede a precharge signal of a predetermined voltage level with said picture signal by two or more 3rd switching elements at said two or more data lines, and are supplied, respectively. In a location which counters one [at least] element of said 2nd and 3rd switching elements which one [said / at least] circuit has in said 1st switching element list, respectively It is characterized by having further a protection-from-light layer prepared, respectively between said 1st substrate and said 1st switching element, and one [this] element.

[0013] According to liquid crystal equipment according to claim 1, a sampling circuit samples a picture signal by two or

more 2nd switching elements which consist of TFT etc., and supplies it to two or more data lines. A precharge circuit precedes a precharge signal of a predetermined voltage level with a picture signal by two or more 3rd switching elements which consist of TFT etc. at two or more data lines, and supplies it, respectively. One [at least] circuit is established in the 1st substrate among these sampling circuits and precharge circuits. Here, a protection-from-light layer is prepared in a location which counters one [at least] element of the 2nd and 3rd switching elements which one circuit has, respectively even if this ** cannot be found in the 1st switching element list between the 1st substrate, the 1st switching element, and one [this] element, respectively. Therefore, even if return light etc. carries out incidence from the 1st substrate side, before carrying out incidence to the 1st, 2nd, and 3rd switching elements which consist of TFT etc., for example, this return light etc. is shaded by protection-from-light layer formed in a location which counters these, respectively. For this reason, the situation where a photocurrent occurs according to the photo-electric-conversion effect in the 1st, 2nd, and 3rd switching elements which consist of TFT etc., for example, and a switching characteristic deteriorates is prevented beforehand. Furthermore, in this way, since protection from light about a sampling circuit or a precharge circuit is given, the need of arranging these circuits into a circumference portion of the 1st substrate into which it was put by case of protection-from-light nature like before is lost. For example, these circuits can also be arranged to a part for 1st set Itabe which counters circumference abandonment of protection-from-light nature formed in the 2nd substrate.

[0014] In order that liquid crystal equipment according to claim 2 may solve the above-mentioned technical problem, in liquid crystal equipment according to claim 1, at least one of said 1st, 2nd, and 3rd switching elements consists of a thin film transistor, and it is characterized by including a semiconductor layer which constitutes this thin film transistor formed through an insulator layer on said protection-from-light layer.

[0015] According to liquid crystal equipment according to claim 2, among the 1st, 2nd, and 3rd switching elements at least one Although a semiconductor layer which constitutes a thin film transistor (TFT) formed through an insulator layer on a protection-from-light layer is included, even if return light etc. carries out incidence from the 1st substrate side, before carrying out incidence to this semiconductor layer, this return light etc. is shaded by protection-from-light layer formed in a location which counters this. For this reason, in this semiconductor layer, a photocurrent occurs according to the photo-electric-conversion effect, and the situation where the transistor characteristics of TFT deteriorate is prevented beforehand.

[0016] In order that liquid crystal equipment according to claim 3 may solve the above-mentioned technical problem, in liquid crystal equipment according to claim 1 or 2, at least one of said 1st, 2nd, and 3rd switching elements consists of a thin film transistor of LDD structure, and it is characterized by preparing said protection-from-light layer in a location which counters a channel field and a LDD field of this thin film transistor at least.

[0017] According to liquid crystal equipment according to claim 3, at least one of the 1st, 2nd, and 3rd switching elements consists of TFT of LDD structure, but Since a protection-from-light layer is prepared in a location which counters this channel field of TFT, and a LDD field at least Even if return light etc. carries out incidence from the 1st substrate side, before carrying out incidence to this channel field and a LDD field, this return light etc. is shaded by protection-from-light layer formed in a location which counters these. For this reason, in this channel field and a LDD field, a photocurrent occurs according to the photo-electric-conversion effect, and the situation where the transistor characteristics of TFT deteriorate is prevented beforehand.

[0018] In order that liquid crystal equipment according to claim 4 may solve the above-mentioned technical problem, in liquid crystal equipment given in any 1 term of claims 1-3, it is characterized by crossing said protection-from-light layer to the whole region, and forming it from the same material of the same thin film formation production process.

[0019] According to liquid crystal equipment according to claim 4, although a protection-from-light layer is prepared to various kinds of switching elements, it goes across a protection-from-light layer throughout the, and it is formed from the same material of the same thin film formation production process. That is, it becomes possible to form a protection-from-light layer to various kinds of switching elements according to the same production process in a manufacturing process of the liquid crystal equipment concerned in this case.

[0020] In order that liquid crystal equipment according to claim 5 may solve the above-mentioned technical problem, in liquid crystal equipment given in any 1 term of claims 1-4, said protection-from-light layer is characterized by connecting with a constant source of potential.

[0021] According to liquid crystal equipment according to claim 5, since a protection-from-light layer is connected to a constant source of potential, let a protection-from-light layer be constant potential. Therefore, potential fluctuation of a protection-from-light layer does not have a bad influence on a protection-from-light layer to switching elements, such as TFT by which opposite arrangement is carried out.

[0022] In order that liquid crystal equipment according to claim 6 may solve the above-mentioned technical problem, in

liquid crystal equipment according to claim 5, constant potential of said constant source of potential is characterized by being equal to touch-down potential.

[0023] According to liquid crystal equipment according to claim 6, since a protection-from-light layer is made into touch-down potential, potential fluctuation of a protection-from-light layer does not have a bad influence on a protection-from-light layer to switching elements, such as TFT by which opposite arrangement is carried out.

[0024] In order that liquid crystal equipment according to claim 7 may solve the above-mentioned technical problem, it has further a counterelectrode prepared in a side which meets said liquid crystal of said 2nd substrate in liquid crystal equipment according to claim 5, and constant potential of said constant source of potential is characterized by being equal to potential of said counterelectrode.

[0025] According to liquid crystal equipment according to claim 7, since a protection-from-light layer is made into potential of a counterelectrode, potential fluctuation of a protection-from-light layer does not have a bad influence on a protection-from-light layer to switching elements, such as TFT by which opposite arrangement is carried out.

[0026] In order that liquid crystal equipment according to claim 8 may solve the above-mentioned technical problem, in liquid crystal equipment given in any 1 term of claims 1-7, at least one of said 1st, 2nd, and 3rd switching elements is characterized by consisting of a thin film transistor of any one mold in an N channel mold, a P channel mold, and a complementary type.

[0027] According to liquid crystal equipment according to claim 8, it is at least one of the 1st, 2nd, and 3rd switching elements, Although it consists of TFT of any one mold in an N channel mold, a P channel mold, and a complementary type Since a protection-from-light layer is prepared in this location that counters TFT at least, even if return light etc. carries out incidence from the 1st substrate side, before [this] carrying out incidence to TFT, this return light etc. will be shaded by protection-from-light layer formed in a location which counters this. For this reason, in this TFT, a photocurrent occurs according to the photo-electric-conversion effect, and the situation where the transistor characteristics of TFT deteriorate is prevented beforehand.

[0028] In liquid crystal equipment given in any 1 term of claims 1-8 in order that liquid crystal equipment according to claim 9 may solve the above-mentioned technical problem A seal member which sticks said 1st and 2nd substrates in the perimeter of a screen-display field specified with said two or more pixel electrodes on a plane parallel to said 1st and 2nd substrates, and surrounds said liquid crystal, It has further circumference abandonment of protection-from-light nature formed along with an outline of said screen-display field at said 2nd substrate between said seal members and said screen-display fields on said plane, and one [said / at least] circuit is characterized by being prepared in a location which counters said circumference abandonment.

[0029] According to liquid crystal equipment according to claim 9, circumference abandonment of protection-from-light nature is formed along with an outline of a screen-display field at the 2nd substrate between seal members and screen-display fields which surround liquid crystal. Here, among a sampling circuit and a precharge circuit, since one [at least] circuit is established in a location which counters circumference abandonment, if it is called circumference abandonment and says, a deployment of dead space can be aimed at. In this case, before carrying out incidence to a switching element which these sampling circuits and precharge circuits have even if incident light etc. carries out incidence from the 2nd substrate side since especially circumference abandonment is protection-from-light nature, this incident light etc. is shaded by circumference abandonment. Therefore, it originates in incident light etc. and there is no un-arranging [for which a photocurrent occurs according to the photo-electric-conversion effect in a switching element, and a switching characteristic deteriorates]. Thus, if a sampling circuit and a precharge circuit are arranged in a location which counters circumference abandonment, since it is not necessary to give protection from light to light from the 2nd substrate side, it is very advantageous.

[0030] Said two or more data lines are characterized by supplying said precharge signal from the other side while said precharge circuit is prepared in liquid crystal equipment given in any 1 term of claims 1-9 and said picture signal is supplied from one side of said data line, in order that liquid crystal equipment according to claim 10 may solve the above-mentioned technical problem.

[0031] According to liquid crystal equipment according to claim 10, a picture signal is supplied from one side of said data line, and, as for two or more data lines, a precharge signal is supplied from the other side of said data line. Therefore, a precharge circuit can be established in an opposite side across a data-line drive circuit, a sampling circuit, etc. and a screen-display field for supplying a picture signal.

[0032] In liquid crystal equipment given in any 1 term of claims 1-10 in order that liquid crystal equipment according to claim 11 may solve the above-mentioned technical problem An inspection circuit containing the 4th switching element for conducting predetermined inspection to the liquid crystal equipment concerned is further established in said 1st substrate. Said protection-from-light layer It is characterized by being further prepared between said 1st substrate and

said 4th switching element in a location which counters said 4th switching element.

[0033] According to liquid crystal equipment according to claim 11, a protection-from-light layer is prepared in a location which counters the 4th switching element which an inspection circuit has between the 1st substrate and this 4th switching element. Therefore, even if return light etc. carries out incidence from the 1st substrate side, before carrying out incidence to the 4th switching element which consists of TFT etc., for example, this return light etc. is shaded by protection-from-light layer formed in a location which counters this, respectively. For this reason, in the 4th switching element which consists of TFT etc., for example, a photocurrent occurs according to the photo-electric-conversion effect, and the situation where a switching characteristic deteriorates is prevented beforehand. Furthermore, in this way, since protection from light about an inspection circuit is given, it can also arrange to a part for 1st set Itabe which counters circumference abandonment of protection-from-light nature formed in the 2nd substrate.

[0034] Liquid crystal equipment according to claim 12 is set to liquid crystal equipment according to claim 1, in order to solve the above-mentioned technical problem. It replaces with one [said / at least] circuit, and a circumference circuit containing the 5th switching element for voltage maintenance for operating the liquid crystal equipment concerned is established in said 1st substrate. Said protection-from-light layer It is characterized by being prepared between said 1st substrate and said 5th switching element in a location which counters said 5th switching element.

[0035] According to liquid crystal equipment according to claim 12, a protection-from-light layer is prepared in a location which counters the 5th switching element which a circumference circuit has between the 1st substrate and this 5th switching element. Therefore, even if return light etc. carries out incidence from the 1st substrate side, before carrying out incidence to the 5th switching element which consists of TFT etc., for example, this return light etc. is shaded by protection-from-light layer formed in a location which counters this, respectively. For this reason, the situation where a photocurrent occurs according to the photo-electric-conversion effect in the 5th switching element which consists of TFT etc., for example, a switching characteristic deteriorates, and maintenance voltage changes is prevented beforehand. Furthermore, in this way, since protection from light about a circumference circuit is given, it can also arrange to a part for 1st set Itabe which counters circumference abandonment of protection-from-light nature formed in the 2nd substrate.

[0036] It is characterized by electronic equipment according to claim 13 equipping claims 1-12 with liquid crystal equipment of a publication, in order to solve the above-mentioned technical problem.

[0037] According to electronic equipment according to claim 13, electronic equipment is equipped with liquid crystal equipment of the invention in this application mentioned above, and since various kinds of actuation is performed by switching element in which protection-from-light engine performance to return light etc. has the highly excellent switching characteristic, high-definition image display of it becomes possible.

[0038] A liquid crystal light valve with which incidence of the light to which outgoing radiation of the projection mold display according to claim 14 is carried out from the light source and this light source is carried out, and it performs a modulation corresponding to image information, In a projection mold indicating equipment which has a delivery system which projects light modulated with said liquid crystal light valve said liquid crystal light valve Liquid crystal equipment with which liquid crystal was pinched between the 2nd substrate arranged at a 1st substrate [which has been arranged at an incidence side of light], and outgoing radiation side, It consists of the 1st polarization means arranged on the outside of said 1st substrate, and the 2nd polarization means arranged on the outside of said 2nd substrate. On said 2nd substrate Two or more scanning lines, two or more data lines which intersect said two or more scanning lines, and two or more 1st thin film transistors connected to two or more of said scanning lines and data lines, It has two or more pixel electrodes connected to said two or more 1st thin film transistors. Between said 2nd substrate and said 1st thin film transistor, it is characterized by thing of said 1st thin film transistor which come to arrange a protection-from-light layer at least corresponding to a channel field, and it comes to form space between said 2nd polarization means and said liquid crystal equipment.

[0039] According to the projection mold indicating equipment according to claim 14, leakage current by return light can be prevented by forming a protection-from-light layer between the 2nd substrate and the 1st thin film transistor. Moreover, since effect on a liquid crystal light valve by return light can be prevented, it is not necessary to stick a polarization means with an antireflection film on liquid crystal equipment like before. therefore -- without it sticks the 2nd polarization means on liquid crystal equipment -- alienation -- since it can form, a temperature rise of a liquid crystal light valve can be prevented.

[0040] A color separation means by which a projection mold display according to claim 15 separates into a colored light bunch of at least 2 colors the flux of light by which outgoing radiation is carried out from the light source and this light source, A liquid crystal light valve which performs a modulation corresponding to image information to the flux of light of each color separated by said color separation means, In a projection mold display which has a synthetic means to

compound light modulated with said liquid crystal light valve, and a delivery system which projects the synthetic flux of light by which outgoing radiation was carried out from said synthetic means Liquid crystal equipment with which it comes to pinch liquid crystal between the 2nd substrate arranged at a 1st substrate [with which said liquid crystal light valve has been arranged at an incidence side of light], and outgoing radiation side of light, It has the 1st polarization means arranged on the outside of said 1st substrate, and the 2nd polarization means arranged on the outside of said 2nd substrate. On said 2nd substrate Two or more scanning lines, two or more data lines which intersect said two or more scanning lines, and two or more 1st thin film transistors connected to two or more of said scanning lines and data lines, It has two or more pixel electrodes connected to said two or more 1st thin film transistors. Between said 2nd substrate and said 1st thin film transistor, it is characterized by thing of said 1st thin film transistor for which it comes to arrange a protection-from-light layer at least corresponding to a channel field, and said 2nd polarization means is stuck on said synthetic means.

[0041] According to the projection mold display according to claim 15, since the 2nd polarization means is stuck on a synthetic means, space is formed between liquid crystal equipment and the 2nd polarization means. Therefore, a temperature rise of liquid crystal equipment can be avoided and malfunction of a liquid crystal light valve can be prevented.

[0042] A projection mold display according to claim 16 is characterized by said synthetic means consisting of a prism unit in a projection mold display according to claim 15.

[0043] According to the projection mold display according to claim 16, said synthetic means consists of a prism unit, and the 2nd polarization means is stuck on a prism unit. A prism unit is effective in order to be able to absorb heat capacity of the 2nd polarization means in a prism unit since heat capacity is large, and to prevent a temperature rise of a liquid crystal light valve.

[0044] A projection mold display according to claim 17 is characterized by having further a cooling means to send cold blast between said liquid crystal equipment and said 2nd polarization means in a projection mold display according to claim 15 or 16.

[0045] According to the projection mold display according to claim 17, by forming a cooling means, for example in either a synthetic means top or the bottom, and sending cold blast between liquid crystal equipment and a polarization means from a cooling means, a temperature rise of a liquid crystal light valve can be prevented further, and malfunction of a liquid crystal light valve can be prevented.

[0046] Such an operation and other gains of this invention are made clear from a gestalt of operation explained below.

[0047]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained based on a drawing.

[0048] (Configuration of liquid crystal equipment) The configuration of the gestalt of operation of liquid crystal equipment is explained based on drawing 5 from drawing 1.

[0049] First, the whole liquid crystal equipment configuration is explained with reference to drawing 3 from drawing 1. Drawing 1 is the block diagram showing the configuration of a various wiring, a circumference circuit, etc. which were prepared on the TFT array substrate in the gestalt of operation of liquid crystal equipment, drawing 2 is the plan which looked at the TFT array substrate from the opposite substrate side with each component formed on it, and drawing 3 is a H-H' cross section of drawing 2 shown including an opposite substrate.

[0050] Liquid crystal equipment 200 is equipped with the TFT array substrate 1 which consists of a quartz substrate, hard glass, a silicon substrate, etc. in drawing 1. Two or more pixel electrodes 11 prepared in the shape of a matrix on the TFT array substrate 1, The data line 35 which two or more arrays are carried out in the direction of X, and is extended along the direction of Y, respectively, The scanning line 31 which two or more arrays are carried out in the direction of Y, and is extended along the direction of X, respectively, While intervening between each data line 35 and the pixel electrode 11, respectively, two or more TFT30 as an example of the switching element which controls the switch-on and the non-switch-on between these according to the scan signal supplied through the scanning line 31, respectively, respectively is formed. Moreover, on the TFT array substrate 1, capacity line 31' (the 2nd storage capacitance electrode) which is wiring for the below-mentioned storage capacitance (refer to drawing 6) is formed in parallel with the scanning line 31.

[0051] The precharge circuit 201 which precedes the precharge signal of a predetermined voltage level with a picture signal, and supplies it to further two or more data lines 35 on the TFT array substrate 1, respectively, the sampling circuit 301 which samples a picture signal and is supplied to two or more data lines 35, respectively, the data-line drive circuit 101, and the scanning-line drive circuit 104 are formed.

[0052] The scanning-line drive circuit 104 impresses a scan signal to the scanning line 31 by line sequential in pulse to predetermined timing based on a power supply, a reference clock, etc. which are supplied from an external-control

circuit.

[0053] Based on a power supply, a reference clock signal, etc. which are supplied from an external-control circuit, according to the timing which impresses a scan signal, a sampling circuit driving signal is minded every data line 35, and the scanning-line drive circuit 104 minds [301] the sampling circuit drive signal line 306, and carries out sequential supply of the data-line drive circuit 101 to predetermined timing about six picture signal line 304 each.

[0054] The precharge circuit 201 is equipped with TFT202 every data line 35, the precharge signal line 204 is connected to the source electrode of TFT202, and the precharge circuit drive signal line 206 is connected to the gate electrode of TFT202. And the power supply of predetermined voltage required in order to write in a precharge signal (NRS) from an external power is supplied through the precharge signal line 204, and a precharge circuit driving signal (NRG) is supplied from an external-control circuit so that a precharge signal may be written in through the precharge circuit drive signal line 206 to the timing preceded with a picture signal (VID1-VID6) about each data line 35. The precharge circuit 201 supplies the precharge signal (image auxiliary signal) which is preferably equivalent to the pixel data of middle gradation level.

[0055] The sampling circuit 301 is equipped with TFT302 every data line 35, the picture signal line 304 is connected to the source electrode of TFT302, and the sampling circuit drive signal line 306 is connected to the gate electrode of TFT302. And if six parallel picture signals (VID1-VID6) are inputted through the picture signal line 304, these picture signals (VID1-VID6) will be sampled. Moreover, if a sampling circuit driving signal is inputted from the data-line drive circuit 101 through the sampling circuit drive signal line 306, sequential impression of the picture signal sampled about six picture signal line 304 each will be carried out at the data line 3. That is, the data-line drive circuit 101 and the sampling circuit 301 are constituted so that the parallel picture signal (VID1-VID6) which was inputted from the picture signal line 304 and which was developed six phases may be supplied to the data line 35. Although the gestalt of this operation described the method which makes sequential selection of the data line 35 for [every], the method which chooses as coincidence the sampling circuit 301 connected to the six adjoining data lines 35, for example, and consists of the six data lines 35 and which carries out the sequential transfer for every group may be used. Selection of the data line 35 may choose as coincidence 2 which adjoins each other, 3, --, 5, or 7 or more. moreover, as long as the write-in property of TFT302 which constitutes not only six phases but the sampling circuit 301 of the number of phase expansions of the picture signal supplied to the data line 35 is good, five or less phases are sufficient as it -- if it carries out and the dot frequency of a picture signal is high -- the increase more than seven phase -- you may carry out. Under the present circumstances, it cannot be overemphasized that the image input signal line only of the number of phase expansions of a picture signal is necessity at least.

[0056] Especially with the gestalt of this operation, the protection-from-light layer 3 (it mentions later) is formed in the TFT302 bottom which TFT30 prepared in each pixel, TFT202 which the precharge circuit 201 has, and a sampling circuit 301 have, respectively. Therefore, even if return light etc. carries out incidence from the TFT array substrate 1 side, before carrying out incidence to TFT 30,202 and 302, this return light etc. is shaded by the protection-from-light layer 3 formed in the location which counters these, respectively. For this reason, the situation where a photocurrent occurs according to the photo-electric-conversion effect in TFT 30,202 and 302, and transistor characteristics deteriorate is prevented beforehand, and the defect who spoils image quality grace, such as a flicker and a cross talk, remarkably is not generated. In addition, about the concrete lamination of the protection-from-light layer 3, it mentions later.

[0057] Moreover, with the gestalt of this operation, the protection-from-light layer 3 of TFT 30,202 and 302 formed in the bottom of a channel field at least is connected to a constant potential line like touch-down potential, and an electric target. This is for preventing change of the transistor characteristics which happen when the unstable potential difference arises between each terminal of TFT 30,202 and 302. As a constant potential line, you may connect with the power supply of the positive potential supplied to the data-line drive circuit 101 or scanning-line drive circuit 104 grade, or negative potential, and the wiring and the electric target which supplies counterelectrode potential to the opposite substrate 2, for example. As shown in drawing 1 , the constant potential line 501 installed from the power supply of the negative potential of the scanning-line drive circuit 104 etc. is electrically connected to the protection-from-light layer 3 around the screen-display field. Moreover, you may use with the constant potential line 501 supplied to capacity line 31' for forming the storage capacitance of a pixel in common. If such a configuration is taken, since leading-about wiring can be managed with one, it is advantageous, in case the space which makes a circumference circuit spreads or liquid crystal equipment is miniaturized. Moreover, since the external input terminal of dedication is not needed, a leeway is given to a space and the cost cut of a mounting member can be aimed at. However, it cannot be overemphasized that the external input terminal of dedication and wiring may be prepared and constant potential may be supplied.

[0058] Furthermore, in this way, since protection from light is given to the return light from the TFT array substrate 1 side about the precharge circuit 201 or the sampling circuit 301, the need of arranging these circuits into the

circumference portion of the TFT array substrate 1 into which it was put by the case of protection-from-light nature like before is lost. So, with the gestalt of this operation, as the slash field in drawing 1 shows, and as it is shown in drawing 2 and drawing 3, the precharge circuit 201 and the sampling circuit 301 are formed on the TFT array substrate 1 in the location which counters the circumference abandonment 53 of the protection-from-light nature formed in the opposite substrate 2. On the other hand, the data-line drive circuit 101 and the scanning-line drive circuit 104 are formed on the narrow long and slender circumference portion of the TFT array substrate 1 which does not face the liquid crystal layer 50.

[0059] In drawing 2 and drawing 3, the sealant 52 which consists of a photoresist as an example of the seal member which sticks both substrates in the perimeter of the screen-display field (namely, field of the liquid crystal equipment with which an image is actually displayed by the orientation change of state of the liquid crystal layer 50) specified with two or more pixel electrodes 11, and surrounds the liquid crystal layer 50 is formed along the screen-display field on the TFT array substrate 1. And between the screen-display fields and sealants 52 on the opposite substrate 2, the circumference abandonment 53 of protection-from-light nature is formed.

[0060] When put into the TFT array substrate 1 by the case of protection-from-light nature where opening was behind prepared corresponding to the screen-display field, the circumference abandonment 53 so that the screen-display field concerned may not hide in the edge of the opening of the case concerned according to a manufacture error etc. That is, it is formed from the band-like protection-from-light nature material which has width of face of 500 micrometers or more in the perimeter of a screen-display field so that the gap of about hundreds of micrometers to the case of the TFT array substrate 1 may be permitted, for example. Such circumference abandonment 53 of protection-from-light nature is formed in the opposite substrate 2 of sputtering and the photolithography which used metallic materials, such as Cr (chromium), nickel (nickel), and aluminum (aluminum), and etching. Or it is formed from materials, such as resin black which distributed carbon and Ti (titanium) to the photoresist.

[0061] The data-line drive circuit 101 and the mounting terminal 102 are formed in the field of the outside of a sealant 52 along the lower side of a screen-display field, and the scanning-line drive circuit 104 is established in it along with two sides of right and left of a screen-display field. Furthermore, two or more wiring 105 for connecting between the scanning-line drive circuits 104 established in the both sides of a screen-display field is formed in the surface of a screen-display field. Moreover, in at least one place of the corner section of the opposite substrate 2, the fish eye 106 which consists of flow material for taking an electric flow between the TFT array substrate 1 and the opposite substrate 2 is formed. And the opposite substrate 2 with the almost same outline as a sealant 52 has fixed to the TFT array substrate 1 by the sealant 52 concerned.

[0062] The precharge circuit 201 and a sampling circuit 301 are circuits of an alternating current drive fundamentally. For this reason, even if it establishes these precharge circuits 201 and sampling circuits 301 in TFT array substrate 1 portion which faces the liquid crystal layer 50 which was surrounded by the sealant 52 and pinched among both substrates, the problem of deterioration of the liquid crystal layer 50 by direct-current-voltage impression is not produced. On the other hand, the data-line drive circuit 101 and the scanning-line drive circuit 104 are established in the circumference portion of the TFT array substrate 1 which does not face the liquid crystal layer 50. Therefore, it can prevent beforehand that the direct-current-voltage component from the data-line drive circuit 101 or the scanning-line drive circuit 104 by which especially a direct-current drive is carried out leaks to the liquid crystal layer 50, and is impressed to it.

[0063] Thus, it becomes easy to design these circumference circuits so that it can have additional coverage, the scanning-line drive circuit 104 and the data-line drive circuit 101 can be formed in the circumference portion of the TFT array substrate 1 by forming the precharge circuit 201 and a sampling circuit 301 and it may meet under the circumference abandonment 53 at specific specification. Moreover, reduction of the display area in liquid crystal equipment 200 is not caused by establishing the precharge circuit 201 and a sampling circuit 301 in the bottom of the circumference abandonment 53 which is dead space so to speak.

[0064] And since the circumference abandonment 53 is protection-from-light nature in one side, there is no necessity of establishing separately the protection-from-light means against the incident light which carries out incidence from the opposite substrate 2 side on the precharge circuit 201 or a sampling circuit 301 (namely, TFT 202 and 302). On the other hand, a protection-from-light layer can shade the return light of the precharge circuit 201 or a sampling circuit 301 (namely, TFT 202 and 302) which carries out incidence from the TFT array substrate 1 side since it is prepared in the bottom of a channel field at least, before reaching the precharge circuit 201 and a sampling circuit 301 (namely, TFT 202 and 302). Thereby, since there is nothing of TFT202 of the precharge circuit 201 or TFT302 of a sampling circuit 301 for which light is irradiated by the channel field at least, in this field, a photocurrent occurs according to the photo-electric-conversion effect, and the transistor characteristics of TFT 202 and 302 do not deteriorate. Therefore, even if

light carries out incidence of the gestalt of this operation from which liquid crystal equipment side, it has the advantage in which it can shade certainly and can abolish the defect who reduces image quality grace, such as a flicker and a cross talk, remarkably.

[0065] In addition, since neither the precharge circuit 201 nor a sampling circuit 301 is necessarily formed in TFT array substrate 1 portion which faces a sealant 52, there is no possibility of destroying TFT 202 and 302 which constitutes these circuits with the spacer mixed in the sealant 52, and it can fully irradiate light from both the substrates side further at the production process to which photo-curing of the sealant 52 is carried out.

[0066] As shown in drawing 1, with the gestalt of this operation, a picture signal is supplied from the end which two or more data lines 35 have the lower side of a screen-display field, and a precharge signal is supplied from the other end in an another side side. Therefore, the precharge circuit 201 can be established in an opposite side across the data-line drive circuit 101 and the sampling circuit 301, and screen-display field for supplying a picture signal, and the space under the circumference abandonment 53 can be effectively used with sufficient balance.

[0067] Next, the concrete circuitry of TFT 202 and 302 which constitutes the precharge circuit 201 and a sampling circuit 301 is explained with reference to drawing 4 and drawing 5, respectively. In addition, drawing 4 is the circuit diagram showing various kinds of TFT(s) which constitute TFT202 of the precharge circuit 201, and drawing 5 is the circuit diagram showing various kinds of TFT(s) which constitute TFT302 of a sampling circuit 301.

[0068] As shown in drawing 4 (1), TFT202 (refer to drawing 1) of the precharge circuit 201 may consist of N channel mold TFT202a, as shown in drawing 4 (2), may consist of P channel mold TFT202b, and may consist of complementary-type TFT202c which consists of the N channel mold TFT and the P channel mold TFT as shown in drawing 4 (3). In addition, the precharge circuit driving signals 206a and 206b inputted in drawing 4 (3) through the precharge circuit drive signal line 206 shown in drawing 1 from drawing 4 (1) are inputted into each TFT(s) 202a-202c as gate voltage. The precharge signal NRS inputted through the precharge signal line 204 similarly shown in drawing 1 is inputted into each TFT(s) 202a-202c as source voltage. Precharge circuit driving signal 206a impressed to N channel mold TFT202a as gate voltage and precharge circuit driving signal 206b impressed to P channel mold TFT202b as gate voltage are reversal signals mutual. Therefore, in constituting the precharge circuit 201 from complementary-type TFT202c, at least two or more precharge circuit drive signal lines 206 are needed. Thus, when the precharge circuit drive signal line 206 becomes two or more, one screen-display field side may be wired intensively, and you may wire from the both sides of a screen-display field combining the precharge signal line 204. Or for example, precharge circuit driving signal 206a may be reversed with an inverter before complementary-type TFT202c, and precharge circuit driving signal 206b may be formed.

[0069] As shown in drawing 5 (1), TFT302 (refer to drawing 1) of a sampling circuit 301 may consist of N channel mold TFT302A, as shown in drawing 5 (2), it may consist of P channel mold TFT302B, and as shown in drawing 5 (3), it may consist of complementary-type TFT302C. In addition, the picture signal VID inputted in drawing 5 (3) through the picture signal line 304 shown in drawing 1 from drawing 5 (1) is inputted into each TFT(s) 302a-302c as source voltage. The sampling circuit driving signals 306a and 306b inputted through the sampling circuit drive signal line 306 from the data-line drive circuit 101 similarly shown in drawing 1 are inputted into each TFT(s) 302a-302c as gate voltage. Moreover, also in a sampling circuit 301, sampling circuit driving signal 306a impressed to N channel mold TFT302a as gate voltage and sampling circuit driving signal 306b impressed to P channel mold TFT302B as gate voltage are reversal signals like the case of the above-mentioned precharge circuit 201 mutual. Therefore, in constituting a sampling circuit 301 from complementary-type TFT302C, sampling circuit driving signal 306a and at least two or more sampling circuit drive signal lines 306 for 306b are needed.

[0070] (Configuration of liquid crystal equipment) Next, the concrete configuration of the liquid crystal equipment portion which liquid crystal equipment 200 contains is explained with reference to drawing 8 from drawing 6. here -- drawing 7 -- drawing 1 -- setting -- a circle -- surrounding -- having had -- D -- a field -- having expanded -- a plan -- it is -- drawing 6 -- drawing 7 -- it can set -- TFT -- 30 -- A-A -- ' -- having met -- a cross section -- precharge -- a circuit -- 201 -- TFT -- 202 -- B-B -- ' -- having met -- a cross section -- expressing -- ****. In addition, in order to make each class and each part material into the magnitude of the degree which can be recognized on a drawing, contraction scales are made to have differed for each class or every each part material in drawing 6.

[0071] In TFT30 portion in which liquid crystal equipment 200 is formed in each pixel in the cross section of drawing 6 It has [between the protection-from-light layer 3 by which the laminating was carried out to the TFT array substrate 1 list on it, and the 1st layer] the insulating layer 43, the pixel electrode 11, and the orientation film 12 between an insulating layer 42, the data line 35 (source electrode), and the 3rd layer between an insulating layer 41, the semiconductor layer 32, the gate insulating layer 33, the scanning line 31 (gate electrode), and the 2nd layer. Liquid crystal equipment 200 is equipped with the common electrode 21, the orientation film 22, and the 2nd protection-from-

light layer 23 by which the laminating was carried out to the opposite substrate 2 list which consists of a glass substrate on it again. Liquid crystal equipment 200 is further equipped with the liquid crystal layer 50 pinched among both these substrates.

[0072] Here, the configuration of each class except TFT30 is first explained in order among these layers.

[0073] In the location which counters TFT30, respectively, the protection-from-light layer 3 is formed on the TFT array substrate 1, respectively. The protection-from-light layer 3 consists of metal alloys, such as a metal containing at least one, such as Ti (titanium), Cr (chromium), W (tungsten), Ta (tantalum), Mo (molybdenum), and Pd (lead), or metal silicide (for example, tungsten silicide WSi). If the protection-from-light film 3 is constituted from refractory metal silicide (i.e., if silicon is included in the material of the protection-from-light layer 3), the TFT array substrate 1 which comes to contain silicon, and thermal affinity with the insulating layer 41 between the 1st layer will become good.

[0074] Moreover, as shown in drawing 7, the protection-from-light layer 3 is grounded through the constant potential line 501 through the contact hole 503, or is connected to the constant source of potential. It is good to install wiring of the power supply supplied to the data-line drive circuit 101 or the circumference circuit of scanning-line drive circuit 104 grade as a constant potential line 501. For this reason, when the potential of the protection-from-light layer 3 changes, it does not have a bad influence on the switching characteristic of TFT30 etc. For example, it may be grounded, or it may connect with the common electrode 21, and the protection-from-light layer 3 may be made into the potential of the common electrode 21. However, the protection-from-light layer 3 may be floating electrically. Moreover, it is also possible to use the protection-from-light layer 3 as wiring for the below-mentioned storage capacitance (to refer to drawing 6).

[0075] Furthermore, between the protection-from-light layer 3 and two or more TFT30, the insulating layer 41 is formed between the 1st layer. Between the 1st layer, it consists of silicate glass films, such as NSG (non dope silicate glass), PSG (phosphorus silicate glass), BSG (boron silicate glass), and BPSG (boron phosphorus silicate glass), a silicon nitride film, a silicon oxide film, etc., and an insulating layer 41 is formed in order to carry out the electric insulation of the semiconductor layer 32 which constitutes TFT30 from the protection-from-light layer 3. Furthermore, an insulating layer 41 also has a function as a substrate film for TFT30 by being formed all over the TFT array substrate 1 between the 1st layer. That is, it has the function to prevent deterioration of the property of TFT30 with the dry area at the time of polishing of the surface of the TFT array substrate 1, the dirt which remains after washing.

[0076] An insulating layer 43 consists of silicate glass films, such as NSG, PSG, BSG, and BPSG, a silicon nitride film, a silicon oxide film, etc. between an insulating layer 42 and the 3rd layer between the 2nd layer, respectively.

[0077] The pixel electrode 11 consists of transparence conductivity thin films, such as for example, an ITO film (indium Tin oxide film). In addition, when using the liquid crystal equipment 200 concerned for the liquid crystal equipment of a reflective mold, the pixel electrode 11 may be formed from an opaque material with high reflection factors, such as aluminum.

[0078] Rubbing processing is performed in the predetermined direction so that the orientation film 12 may consist of organic thin films, such as for example, a polyimide thin film, and it may have a predetermined pre tilt angle.

[0079] It goes across the common electrode 21 all over the opposite substrate 2, and it is formed from the ITO film etc.

[0080] Rubbing processing is performed in the predetermined direction so that the orientation film 22 may consist of organic thin films, such as for example, a polyimide thin film, and it may have a predetermined pre tilt angle.

[0081] The 2nd protection-from-light layer 23 is formed in the predetermined field which counters TFT30 from materials, such as resin black which distributed metallic materials and carbon, such as Cr and nickel, and Ti to the photoresist. The 2nd protection-from-light layer 23 has functions other than the protection from light to the semiconductor layer 32 of TFT30, such as improvement in contrast, and color mixture prevention of color material.

[0082] The liquid crystal layer 50 is formed when liquid crystal is enclosed with the space surrounded by the sealant 52 (refer to drawing 2 and drawing 3) between the TFT array substrates 1 and the opposite substrates 2 which have been arranged so that the pixel electrode 11 and the common electrode 21 may meet by vacuum suction etc. The liquid crystal layer 50 takes a predetermined orientation condition with the orientation films 12 and 22 in the condition that the electric field from the pixel electrode 11 are not impressed. The liquid crystal layer 50 consists of liquid crystal which mixed the pneumatic liquid crystal of a kind or some kinds. It is the adhesives which consist of a photoresist or thermosetting resin in order that a sealant 52 may stick two substrates 1 and 2 around those, and the spacer for making distance between both substrates into a predetermined value is mixed.

[0083] Next, the configuration of each class concerning TFT30 is explained in order.

[0084] TFT30 is equipped with the source field 34 formed in the gate insulating layer 33 which insulates the semiconductor layer 32 in which a channel is formed of the electric field from the scanning line 31 (gate electrode) and the scanning line 31, and the scanning line 31 and the semiconductor layer 32, and the semiconductor layer 32, the data

line 35 (source electrode), and the drain field 36 formed in the semiconductor layer 32. One to which it corresponds of two or more pixel electrodes 11 is connected to the drain field 36. The source field 34 and the drain field 36 are formed by doping the object for the N type of predetermined concentration, or the dopant for P type to the semiconductor layer 32 like the after-mentioned according to whether TFT of N type or P type is formed. TFT of an N type channel has the advantage that a working speed is quick, and it is used as TFT30 which is the switching element of a pixel in many cases.

[0085] TFT30 has LDD structure preferably. However, TFT30 may have the offset structure where an ion implantation is not performed in the low-concentration source drain field in LDD structure, and may form the source field 34 and the drain field 36 in self align by using the gate electrode 31 as a mask. You may be TFT of a self aryne mold. Moreover, with the gestalt of this operation, although single gate structure showed TFT30, between the source field 34 and the drain field 36, the dual gate structure which arranged the gate electrode 31 in the two-piece serial is sufficient, and three or more gate electrodes 31 may be arranged. If such structure is taken, since the leakage current at the time of OFF of TFT30 will be reduced, deterioration of image quality grace is not caused.

[0086] The scanning line 31 (gate electrode) is preferably formed from a polish recon film. Or it may be formed from a refractory metal film or metal silicide films, such as W and Mo. in this case, it also becomes possible to omit a part or all of the 2nd protection-from-light layer 23 by the protection-from-light nature which a metal membrane metallurgy group silicide film has if the 2nd protection-from-light layer 23 arranges the scanning line 31 (gate electrode) as the part or the protection-from-light film which boils all and corresponds of a wrap field. In this case, there is an advantage which can prevent decline in the pixel numerical aperture by the lamination gap with the opposite substrate 2 and the TFT array substrate 1 especially.

[0087] The gate insulating layer 33 consists of a thermal oxidation film of comparatively thin thickness. In addition, when using a large-sized substrate 8 inches or more, in order to prevent the camber of the substrate by heat, thermal oxidation time amount is shortened, a thermal oxidation film is made thin, a high-temperature-oxidation silicon film (HTO film) and a silicon nitride film are deposited with a CVD method etc. on this thermal oxidation film, and the multilayer gate insulator layer structure more than two-layer may be formed.

[0088] Although a photocurrent will occur according to the photo-electric-conversion effect which a polish recon film has and the transistor characteristics of TFT30 will deteriorate if light carries out incidence of the semiconductor layer 32 in which a channel is generally formed With the gestalt of this operation, since two or more 2nd protection-from-light layers 23 are formed in the location which counters the opposite substrate 2 at each TFT30, respectively to light, such as incident light from the opposite substrate 2 side, the thing of the semiconductor layer 32 done to a channel field for incidence at least is prevented for the incident light on which it was projected. By the way, the 2nd protection-from-light layer 23 formed on the opposite substrate 2 may be formed on the TFT array substrate 1. In this case, if Ti (titanium) etc. is formed through an insulator layer, respectively between the data line 35 and the pixel electrode 11, the 2nd protection-from-light layer 23 on the opposite substrate 2 is omissible. Therefore, since it is not necessary to take into consideration the alignment precision at the time of the assembly of the opposite substrate 2 and the TFT array substrate 1, liquid crystal equipment without dispersion in permeability can be offered.

[0089] The data line 35 (source electrode) may be formed from transparence conductivity thin films, such as an ITO film, like the pixel electrode 11. Or you may form from low resistance metal metallurgy group silicide, such as aluminum, etc.

[0090] furthermore, the gate electrode of TFT30 which replace with in addition to this and consist of a part of scanning line 31 -- the wrap from a top -- if the data line 35 (source electrode) be form from opaque metal thin films, such as aluminum, like -- the 2nd protection from light layer 23 -- or independent -- the semiconductor layer 32 -- the exposure of the incident light (namely, drawing 6 light from a top) to a channel field can be prevent effectively at least. Here, the data line 35 is good in TFT30 to form so that the joint of the channel field of the semiconductor layer 32 and the source drain fields 34 and 36 and the protection-from-light layer 3 arranged in these lower parts may be covered at least. This is for preventing the light which carried out incidence from the opposite substrate 2 side reflecting on the surface of the protection-from-light layer 3, and irradiating a channel field. On the other hand, since two or more protection-from-light layers 3 are formed in the location which counters the TFT array substrate 1 at each TFT30, respectively to light, such as return light from the TFT array substrate 1 side, the thing of the semiconductor layer 32 done to a channel field for incidence at least is prevented for return light etc.

[0091] Moreover, the contact hole 38 which leads to the contact hole 37 and the drain field 36 which lead to the source field 34 is formed in the insulating layer 42 between the 2nd layer, respectively. Electrical installation of the data line 35 (source electrode) is carried out to the source field 34 through the contact hole 37 to this source field 34. Furthermore, the contact hole 38 to the drain field 36 is formed in the insulating layer 43 between the 3rd layer. Electrical installation

of the pixel electrode 11 is carried out to the drain field 36 through the contact hole 38 to this drain field 36. The above-mentioned pixel electrode 11 is formed in the upper surface of an insulating layer 43 between the 3rd layer constituted in this way.

[0092] Here, as shown in the plan of drawing 7, the pixel electrode 11 constituted as mentioned above is arranged in the shape of a matrix on the TFT array substrate 1, adjoins each pixel electrode 11, and TFT30 is formed, and the data line 35 (source electrode) and the scanning line 31 (gate electrode) are formed respectively along the boundary of the pixel electrode 11 in every direction. Moreover, it turns out that the protection-from-light layer 3 has covered the channel portion of TFT30 etc. from the bottom. In drawing 7, the constant potential line 501 installed from the power supply of the negative potential of the scanning-line drive circuit 104 located in the direction of C is arranged to the nearest to a screen-display field. Here, it connects with the protection-from-light layer 3 electrically through a contact hole 503. The protection-from-light layer 3 is arranged in the lower part in parallel along with the scanning line 31. Moreover, even if there is little TFT202 of the precharge circuit 201, protection-from-light layer 3" is formed so that the bottom of the channel field of semiconductor layer 32" may be covered, and, on the other hand, a screen-display field is wired in parallel with the scanning line 31 from an edge to the edge of the opposite side. Furthermore, it connects with the constant potential line 501 electrically through a contact hole 503 so that transistor characteristics may not deteriorate. Moreover, by forming the constant potential line 501, the precharge circuit 201, the precharge circuit drive signal line 206, and precharge signal-line 204 grade in the bottom of the circumference abandonment 53 which was dead space conventionally, the field which makes a circumference circuit can be expanded or the miniaturization of liquid crystal equipment can be realized. In addition, drawing 7 is on account of explanation to simplify and show the matrix-like array of the pixel electrode 11 etc., and each actual electrode has the more [in three dimension] complicated configuration so that it may wire through the contact hole etc. and drawing 6 may show between layer insulation layers and a top.

[0093] In drawing 6, storage capacitance 70 is again formed in the pixel electrode 11, respectively. 1st storage capacitance electrode 32' by which installation formation was more specifically [this storage capacitance 70] carried out from the drain field 36 of the semiconductor layer 32, insulating-layer 33' formed of the same production process as the gate insulating layer 33, and the capacity line 31 formed of the same production process as the scanning line 31 -- (the 2nd storage capacitance electrode) -- It consists of some of insulating layers 42 and 43 and pixel electrodes 11 which counter a list at capacity line 31' through the 2nd and the insulating layers 42 and 43 between the 3rd layer between the 2nd and the 3rd layer. Thus, since storage capacitance 70 is formed, even if duty ratio is small, a high definition display is enabled. Moreover, as shown in drawing 7, the constant potential line 501 and capacity line 31' which were installed from the scanning-line drive circuit 104 can be used as a constant potential source of supply by connecting electrically in a contact hole 502. Since the protection-from-light layer 3 and a constant potential line can be shared by this, wiring can be managed with one and it is advantageous in leading about of wiring. Furthermore, since it is not necessary to prepare the external input terminal of dedication, the number of input terminals can be reduced.

[0094] In drawing 6, TFT202 (refer to drawing 1) of the precharge circuit 201 is formed in liquid crystal equipment 200 every data line 35. this -- TFT -- 202 -- more -- concrete -- a semiconductor -- a layer -- 32 -- the same -- a production process -- forming -- having -- a semiconductor -- a layer -- 32 -- " -- the gate -- an insulating layer -- 33 -- the same -- a production process -- forming -- having -- the gate -- an insulating layer -- 33 -- " -- and -- the scanning line -- 31 (gate electrode) -- the same -- a production process -- forming -- having -- precharge -- a circuit -- a drive -- a signal line -- 206 (a semiconductor -- a layer -- 32 -- " -- **** -- TFT -- 30 -- a case -- the same -- the source -- a field -- 34 -- " -- and -- a drain -- a field -- 36 -- " -- preparing -- having -- the -- two -- a layer -- between -- an insulating layer -- 42 -- opening -- having had -- a contact hole -- 38 -- " -- leading -- a drain -- a field -- 36 -- " -- **** -- the data line -- 35 -- connecting -- having -- **** . Moreover, the precharge signal line 204 is connected to source field 34" through contact hole 37" which was able to be opened in the insulating layer 42 between the 2nd layer. And it is prepared so that protection-from-light layer 3" formed of the same production process as the protection-from-light layer 3 on the TFT array substrate 1 in the location which counters TFT202 with such layer structure may cover the bottom of the channel field of semiconductor layer 32" at least. And TFT202 is formed on the TFT array substrate 1 in the location which counters the circumference abandonment 53 of the protection-from-light nature prepared in the opposite substrate 2. It enables this to form a circumference circuit in the nearest to the opening field which light penetrates.

[0095] As shown in the plan of drawing 7, as for the precharge circuit 201, the precharge signal line 204, the precharge circuit drive signal line 206, and the data line 35 are arranged in parallel. In addition, it is not necessary to necessarily arrange a pattern layout in parallel. Electrical installation of the precharge signal line 204 is carried out to each source field of TFT202 through each contact hole 37", and electrical installation of the data line 35 is carried out to each drain field of TFT202 through each contact hole 38." Moreover, opposite arrangement of the precharge circuit drive signal

line 206 is carried out through the gate insulator layer as a gate electrode of TFT202 at the channel portion which connects these source fields and drain fields. And protection-from-light layer 3" is prepared so that a channel portion may be covered with a plan with a gate electrode.

[0096] In addition, although not illustrated to drawing 7, TFT302 (refer to drawing 1) of a sampling circuit 301 is constituted like TFT202 of the precharge circuit 201, and protection-from-light layer 3" is prepared on the TFT array substrate 1 in the location which counters TFT302. And TFT302 is formed on the TFT array substrate 1 in the location which counters the circumference abandonment 53 of the protection-from-light nature prepared in the opposite substrate 2.

[0097] Since it is the same thin film formation production process at the time of formation of TFT30 since TFT30 is TFT which uses a polish recon film as a semiconductor layer, and it can form a sampling circuit 201, the precharge circuit 301, the data-line drive circuit 101, and the circumference circuit of scanning-line drive circuit 104 grade especially with the gestalt of this operation, it is advantageous on manufacture. For example, the data-line drive circuit 101 and the scanning-line drive circuit 104 are formed in the circumference portion on the TFT array substrate 1 from two or more TFT(s) of the complementary structure which consists of an N channel mold TFT and a P channel mold TFT like the case of the precharge circuit 201 and sampling circuit 301 which were shown in drawing 4 (3) and drawing 5 (3).

[0098] Thus, with the gestalt of this operation, since the protection-from-light layer 3 is formed in the channel field bottom at least, respectively and the bad influence by return light etc. of TFT 30,202 and 302 is reduced as mentioned above, the transistor characteristics of TFT30 are improved and, finally liquid crystal equipment 200 enables it to display an image high-definition by high contrast.

[0099] In addition, although not shown in drawing 6, according to the exception of modes of operation, such as for example, TN (Twisted Nematic) mode, STN (super TN) mode, and D-STN (double-STN) mode, and the no MARI White mode / NOMA reeve rack mode, a polarization film, a phase contrast film, a polarization means, etc. are arranged in a predetermined direction at the side in which the incident light of the side in which the incident light of the opposite substrate 2 carries out incidence, and the TFT array substrate 1 carries out outgoing radiation

[0100] Since the liquid crystal equipment 200 explained above is applied to an electrochromatic display projector, three liquid crystal equipments 200 will be used as a light valve for RGB, respectively, and incidence of the light of each color decomposed through the dichroic mirror for RGB color separation, respectively will be carried out to each liquid crystal equipment as incident light, respectively. Therefore, with the gestalt of each operation, the color filter is not prepared in the opposite substrate 2. However, the color filter of RGB may be formed in the predetermined field which counters the pixel electrode 11 with which the black matrix 23 is not formed in liquid crystal equipment 200 on the opposite substrate 2 with the protective coat. If it does in this way, the liquid crystal equipment of the gestalt of this operation is applicable to electrochromatic display equipments, such as electrochromatic display television of direct viewing types other than a liquid crystal projector, or a reflective mold. Furthermore, a micro lens may be formed so that it may correspond 1 pixel on [one] the opposite substrate 2. If it does in this way, bright liquid crystal equipment is realizable by improving the condensing effectiveness of incident light. Furthermore, the die clo IKKU filter which makes a RGB color using interference of light by depositing the interference layer to which the refractive index of many layers is different on the opposite substrate 2 again may be formed. According to this opposite substrate with a die clo IKKU filter, brighter electrochromatic display equipment is realizable.

[0101] Although [liquid crystal equipment 200] incidence of the incident light is carried out from the opposite substrate 2 side as usual, since the protection-from-light layer 3 and 3" exist, incidence of the incident light is carried out from the TFT array substrate 1 side, and it may be made to carry out outgoing radiation from the opposite substrate 2 side. That is, even if it attaches liquid crystal equipment 200 in a liquid crystal projector in this way, it is possible to be able to prevent the thing of the semiconductor layer 32 for channel formation and 32" which light does for incidence to a channel field, and to display a high-definition image on it at least. In order to prevent the reflection by the side of the rear face of the TFT array substrate 1 conventionally, a polarization means by which AR coat was carried out for acid resisting needs to be arranged separately, and AR film needed to be stuck here. However, with the gestalt of this operation, since [of the surface of the TFT array substrate 1 the half-conductor-layer layer 32, and 32"] the protection-from-light layer 3 is formed between channel fields at least, such a polarization means and AR film by which AR coat was carried out are used, or the necessity of using the substrate which carried out AR processing of TFT array substrate 1 itself is lost. Therefore, according to the gestalt of this operation, material cost can be reduced, and a contaminant, a blemish, etc. do not drop the yield at the time of polarization means attachment, and it is very advantageous.

[0102] Moreover, although it was explained that the switching element of liquid crystal equipment 200 was TFT of a positive stagger mold or coplanar mold structure, the gestalt of this operation is effective also to TFT of reverse stagger

mold structure, or TFT of other format.

[0103] Furthermore, in liquid crystal equipment 200, although the liquid crystal layer 50 was constituted from a pneumatic liquid crystal as an example, if the polymer dispersed liquid crystal which distributed liquid crystal as a minute grain in the macromolecule is used, the above-mentioned polarization film, a polarization means, etc. will become unnecessary in the orientation films 12 and 22 and a list, and the advantage of a raise in the brightness of liquid crystal equipment or low-power-izing by efficiency for light utilization increasing will be acquired. Furthermore, when applying liquid crystal equipment 200 to high-reflective-liquid-crystal equipment by constituting the pixel electrode 11 from a metal membrane with high reflection factors, such as aluminum, SH (super HOMEOTORO pick) mold liquid crystal with which perpendicular orientation of the liquid crystal molecule was mostly carried out in the state of no voltage impressing may be used. Furthermore, although the common electrode 21 is provided in the opposite substrate 2 side in liquid crystal equipment 200 again so that perpendicular electric field (vertical electric field) may be impressed to the liquid crystal layer 50 What (that is, the electrode for horizontal electric-field generating is prepared in the TFT array substrate 1 side, without preparing the electrode for vertical electric-field generating in the opposite substrate 2 side) the pixel electrode 11 is constituted also for from an electrode for horizontal electric-field generating of a pair, respectively so that electric field (horizontal electric field) parallel to the liquid crystal layer 50 may be impressed is possible. Thus, if horizontal electric field are used, it is advantageous when extending an angle of visibility rather than the case where vertical electric field are used. In addition, it is possible to apply the gestalt of this operation to various kinds of liquid crystal materials (liquid crystal phase), a mode of operation, a liquid crystal array, the drive method, etc.

[0104] (Actuation of an inspection circuit) With the gestalt of the operation explained above, although the precharge circuit 201 and the sampling circuit 301 were formed, it may replace with these or, in addition, the inspection circuit which has TFT for conducting predetermined inspection for inspecting the quality of the liquid crystal equipment concerned at the manufacture middle or the time of shipment, a defect, etc. may be established in the bottom of the circumference abandonment 53. An example of such an inspection circuit is shown in drawing 9.

[0105] The inspection circuit 401 is equipped with two or more TFT402 in drawing 9. The drive signal lines 403a and 403b for supplying the inspection circuit driving signals TX1 and TX2 to the gate of TFT402, respectively are connected. The inspection signal lines 404a-404d for supplying the inspection signals CX1-CX4, respectively are connected to the source of TFT402. And the data line 35 is connected to the drain of TFT402. In the case of inspection, TFT402 is alternatively turned on and off by the inspection circuit driving signals TX1 and TX2, and the inspection signals CX1-CX4 of predetermined voltage, the precharge signal of predetermined voltage, and the picture signal of predetermined voltage are impressed. And the current value which flows to the inspection signal lines 404a-404d is measured, and it is compared with the current value in the defect-free article obtained experientially or theoretically beforehand. Consequently, inspection of the open circuit during wiring, short (short circuit) inspection during wiring, inspection of the circuit leak in the precharge circuit 201 or a sampling circuit 301, etc. can be conducted comparatively easily by impressing such applied voltage in the combination of a predetermined class, and measuring current.

[0106] Thus, since protection from light of as opposed to [if the protection-from-light layer 3 is formed in the bottom of a channel field at least and an inspection circuit is prepared between the protection-from-light layer 3 and the circumference abandonment 53] the light from both the substrates side of TFT which an inspection circuit has is made also when preparing an inspection circuit, transistor characteristics do not deteriorate by light. Therefore, in case a screen is displayed on usual, image quality grace does not fall remarkably according to the leakage current from the inspection circuit which is not used. In addition, the scanning-line drive circuit 104 and the data-line drive circuit 101 can be formed in the circumference portion of the TFT array substrate 1 with additional coverage, and reduction of the display area in liquid crystal equipment is not caused. In addition, you may make it prepare the precharge circuit of the inspection circuit combination which has the function of an inspection circuit like drawing 9 instead of preparing an inspection circuit like drawing 9.

[0107] Furthermore, it may replace with the precharge circuit 201 and a sampling circuit 301, or, in addition, the circumference circuit which has TFT for voltage maintenance of the data-line drive circuit 101 and scanning-line drive circuit 104 grade for operating the liquid crystal equipment concerned as shown in drawing 8 may be established in the bottom of the circumference abandonment 53. These circumference circuits are formed so that the all or a part may lap with the circumference abandonment 53. If such a configuration is taken, a seal field can expand a circumference circuit field, if it is made to prepare in the outside of a circumference circuit, i.e., the outermost periphery of the TFT array substrate 1. Even if there is little TFT which a circumference circuit has also in this case, the protection-from-light layer 3 is formed in the bottom of a channel field. Thus, if a circumference circuit is prepared between the protection-from-light layer 3 and the circumference abandonment 53, since the protection from light to the light from both the substrates side is made, transistor characteristics do not deteriorate by light (for example, thing which maintenance voltage leaks).

Even if it arranges such a circumference circuit under the circuit of an alternating current drive, then the circumference abandonment 53 especially, the problem of deterioration of the liquid crystal layer 50 by the above-mentioned direct-current-voltage impression is not produced.

[0108] Moreover, you may make it connect with LSI for a drive mounted on TAB (tape automated bonding substrate) instead of forming the data-line drive circuit 101 and the scanning-line drive circuit 104 on the TFT array substrate 1 electrically and mechanically through the anisotropy electric conduction film prepared in the periphery of the TFT array substrate 1.

[0109] (Manufacture process) Next, the manufacture process of liquid crystal equipment 200 including the precharge circuit 201 and a sampling circuit 301 is explained with reference to drawing 12 from drawing 10.

[0110] First, formation of TFT30 portion in which the protection-from-light layer 3 was formed in the TFT array substrate 1 side is explained with reference to drawing 10 and drawing 11.

[0111] As shown in the production process (1) of drawing 10, the TFT array substrates 1, such as a quartz substrate, hard glass, and a silicon substrate, are prepared. Here, preferably, annealing treatment is carried out at inert gas ambient atmospheres, such as N₂ (nitrogen), and an about 900-1300-degree C elevated temperature, and it pretreats so that distortion produced in the TFT array substrate 1 in the elevated-temperature process carried out behind may decrease. That is, according to the temperature by which high temperature processing is carried out at the maximum elevated temperature in a manufacture process, the TFT array substrate 1 is heat-treated at the same temperature or the temperature beyond it in advance.

[0112] Thus, all over the processed TFT array substrate 1, by sputtering etc., it consists of metal alloys, such as a metal containing at least one, such as Ti, Cr, W, Ta, Mo, and Pd, or metal silicide, and the protection-from-light film of about 1000-5000Å thickness is formed. Then, the protection-from-light layer 3 is formed by forming the mask corresponding to the pattern of the protection-from-light layer 3 by the photolithography on the formed this protection-from-light film, and etching to a protection-from-light film through this mask.

[0113] In addition, the protection-from-light layer 3 is formed so that the field, the source field 34, and the drain field 36 for channel formation may be seen and covered from the rear face of the TFT array substrate 1 among the semiconductor layers 32 of TFT30 at least.

[0114] Next, as shown in the production process (2) of drawing 10, while [the 1st layer] consisting of silicate glass films, such as NSG, PSG, BSG, and BPSG, a silicon nitride film, a silicon oxide film, etc. using TEOS (tetrapod ethyl orthochromatic silicate) gas, TEB (tetrapod ethyl boat rate) gas, TMOP (tetrapod methyl oxy-FOSU rate) gas, etc. with ordinary pressure or a reduced pressure CVD method, an insulating layer 41 is formed on the protection-from-light layer 3. The thickness of an insulating layer 41 has desirable about 500-15000Å between the 1st layer. Or after forming a thermal oxidation film, a high-temperature-oxidation silicon film (HTO film) and a silicon nitride film are further deposited on the comparatively thin thickness of about 500Å with a reduced pressure CVD method etc., and an insulating layer 41 may be formed between [with multilayer structure with a thickness of about 2000Å] the 1st layer. Furthermore, a flat film may be formed by piling up or replacing with such a silicate glass film, and carrying out the spin coat of the SOG (spin-on glass: spinning-like glass), or performing CMP (Chemical Mechanical Polishing) processing. Thus, if flattening of the upper surface of an insulating layer 41 is carried out by spin coat processing or CMP processing between the 1st layer, the advantage of being easy to form TFT30 behind in the bottom will be acquired.

[0115] In addition, between the 1st layer, to an insulating layer 41, by performing about 900-degree C annealing treatment, while preventing contamination, flattening may be carried out.

[0116] Next, as shown in the production process (3) of drawing 10, about 450-550 degrees C of amorphous silicon films are preferably formed comparatively on an insulating layer 41 between the 1st layer with the reduced pressure CVD (for example, CVD with a pressure of about 20-40Pa) using the mono-silane gas of flow rate about 400 to 600 cc/min, disilane gas, etc. of about 500 degrees C in low-temperature environment. Then, in nitrogen-gas-atmosphere mind, at about 600-700 degrees C, preferably, solid phase growth of the polish recon film is carried out by ***** which performs annealing treatment of 4 - 6 hours for about 1 to 10 hours until it becomes the thickness of about 1000Å preferably in about 500-2000Å thickness. Under the present circumstances, when creating TFT of an N channel mold, the dopant of V group elements, such as Sb (antimony), As (arsenic), and P (Lynn), may be slightly doped by an ion implantation etc. Moreover, in using TFT as a P channel mold, it dopes slightly the dopant of III group elements, such as aluminum (aluminum), B (boron), Ga (gallium), and In (indium), by an ion implantation etc. In addition, a polish recon film may be directly formed with a reduced pressure CVD method etc. without passing through an amorphous silicon film. Or drive silicon ion into the polish recon film deposited with the reduced pressure CVD method etc., once make it amorphous (amorphous-izing), it is made to recrystallize by annealing treatment etc. after that, and a polish

recon film may be formed.

[0117] Next, as shown in the production process (4) of drawing 10, a thermal oxidation film with a comparatively thin thickness of about 300Å is formed for the semiconductor layer 32 the temperature of about 900-1300 degrees C, and by oxidizing thermally with the temperature of about 1000 degrees C preferably, a high-temperature-oxidation silicon film (HTO film) and a silicon nitride film are further deposited on the comparatively thin thickness of about 500Å with a reduced pressure CVD method etc., and the gate insulating layer 33 with multilayer structure is formed. consequently, the thickness of the semiconductor layer 32 -- the thickness of about 300-1500Å -- desirable -- the thickness of about 350-450Å -- becoming -- the thickness of the gate insulating layer 33 -- the thickness of about 200-1500Å -- it becomes the thickness of about 300Å preferably. Thus, by shortening elevated-temperature thermal oxidation time amount, when using especially an about 8 inches large-sized substrate, the camber by heat can be prevented. However, the gate insulating layer 33 with monolayer structure may be formed only by oxidizing the semiconductor layer 32 thermally.

[0118] Next, as shown in the production process (5) of drawing 10, after depositing a polish recon film with a reduced pressure CVD method etc. through the gate insulating layer 33 on the semiconductor layer 32, the gate electrode 31 (scanning line) is formed according to a photolithography production process, an etching production process, etc.

[0119] However, the gate electrode 31 (scanning line) may be formed in a multilayer combining not a polish recon film but a refractory metal film or a metal silicide film, and a p-Si film. in this case, it also becomes possible to omit a part or all of the 2nd protection-from-light layer 23 by the protection-from-light nature which a metal membrane metallurgy group silicide film has if the 2nd protection-from-light layer 23 arranges the gate electrode 31 (scanning line) as the part or the protection-from-light film which boils all and corresponds of a wrap field. In this case, there is an advantage which can prevent decline in the pixel numerical aperture by the lamination gap with the opposite substrate 2 and the TFT array substrate 1 especially.

[0120] Next, as shown in the production process (6) of drawing 11, when TFT30 is set to TFT of an N channel mold with LDD structure, In order to form the low concentration dope field which constitutes the part which adjoins the semiconductor layer 32 among the source field 34 and the drain field 36 first at a channel side, respectively The gate electrode 31 is used as a diffusion mask. The dopant of V group elements, such as P, by low concentration It dopes. (for example, P ion -- dose of one to 3×10^{13} /cm²) then, after forming a resist layer on the gate electrode 31 with a mask with width of face wider than the gate electrode 31, similarly the dopant of V group elements, such as P, is doped by high concentration (for example, P ion -- the dose of one to 3×10^{15} /cm²). Moreover, in the semiconductor layer 32, when using TFT30 as a P channel mold, in order to form the source field 34 and the drain field 36, the dopant of III group elements, such as B, is used and doped. Thus, when it considers as LDD structure, the advantage which can reduce the short channel effect is acquired. In addition, it is not necessary to dope by dividing into two steps, low concentration and high concentration, in this way. For example, it is good also as TFT of offset structure, without performing a low-concentration dope, and it is good also as TFT of a self aryne mold by the ion-implantation technology using P ion, B ion, etc., using the gate electrode 31 as a mask.

[0121] In parallel to these production processes, the data-line drive circuit 101 and the scanning-line drive circuit 104 with the complementary-type structure which consists of an N channel mold TFT and a P channel mold TFT are formed in the periphery on the TFT array substrate 1. Thus, since TFT30 is poly-Si TFT, at the time of formation of TFT30, it is the same production process, and it can form the data-line drive circuit 101 and the scanning-line drive circuit 104, and is advantageous on manufacture.

[0122] next, it is shown in the production process (7) of drawing 11 -- as -- the gate electrode 31 (scanning line) -- a wrap -- like, using ordinary pressure or a reduced pressure CVD method, TEOS gas, etc., while [the 2nd layer] consisting of silicate glass films, such as NSG, PSG, BSG, and BPSG, a silicon nitride film, a silicon oxide film, etc., an insulating layer 42 is formed. The thickness of an insulating layer 42 has desirable about 5000-15000Å between the 2nd layer. And in order to activate the source field 34 and the drain field 36, after performing about 1000-degree C annealing treatment about 20 minutes, the contact hole 37 to the source electrode 35 (data line) is formed by dry etching, such as reactant etching and reactant ion beam etching. Under the present circumstances, there is an advantage that the direction which punctured the contact hole 37 can make a puncturing configuration almost the same as mask shape by anisotropic etching like reactant etching and reactant ion beam etching. However, if it punctures combining dry etching and wet etching, since a contact hole 37 will be made in the shape of a taper, the advantage that the open circuit at the time of wiring connection can be prevented is acquired. moreover, the contact hole for connecting the gate electrode 31 (scanning line) with the wiring which is not a drawing example is also opened in an insulating layer 42 between the 2nd layer according to the same production process as a contact hole 37.

[0123] Next, as shown in the production process (8) of drawing 11, between the 2nd layer, on an insulating layer 42, low resistance metal metallurgy group silicide, such as aluminum, etc. is deposited on the thickness of about 1000-

5000Å by sputtering processing etc., and the source electrode 35 (data line) is further formed according to a photolithography production process, an etching production process, etc.

[0124] in this case, it also becomes possible to omit a part or all of the 2nd protection-from-light layer 23 by the protection-from-light nature which metal membrane metallurgy group silicide films, such as aluminum, have if the 2nd protection-from-light layer 23 arranges the source electrode 35 (data line) as the part or the protection-from-light film which boils all and corresponds of a wrap field. In this case, there is an advantage which can prevent decline in the pixel numerical aperture by the lamination gap with the opposite substrate 2 and the TFT array substrate 1 especially.

Moreover, the source electrode 35 is formed so that the channel field of the semiconductor layer 32 may be covered at least, and it is made to cover with the source electrode 35 so that incident light may not be further irradiated directly by the surface of the protection-from-light layer 3 arranged in the channel field lower part of the semiconductor layer 32. Thereby, since the channel field of the semiconductor layer 32 can be protected from incident light and return light, the leakage current of TFT by the photo-electric-conversion effect of a polish recon film can be reduced.

[0125] Next, using ordinary pressure or a reduced pressure CVD method, TEOS gas, etc., as shown in the production process (9) of drawing 11, while [the 3rd layer] consisting of silicate glass films, such as NSG, PSG, BSG, and BPSG, a silicon nitride film, a silicon oxide film, etc., an insulating layer 43 is formed, so that the source electrode 35 (data line) top may be covered. The thickness of an insulating layer 43 has desirable about 5000-15000Å between the 3rd layer. or such a silicate glass film -- replacing with -- or -- in piles -- an organic film and SOG (spin-on glass) -- a spin coat -- carrying out -- or -- or CMP processing may be performed and a flat film may be formed.

[0126] Furthermore, the contact hole 38 for carrying out electrical installation of the pixel electrode 11 and the drain field 36 is formed by dry etching, such as reactant etching and reactant ion beam etching. Under the present circumstances, the advantage that the direction which punctured the contact hole 38 can make a puncturing configuration almost the same as mask shape by anisotropic etching like reactant etching and reactant ion beam etching is acquired. However, if it punctures combining dry etching and wet etching, since a contact hole 38 will be made in the shape of a taper, the advantage that the open circuit at the time of wiring connection can be prevented is acquired.

[0127] Next, as shown in the production process (10) of drawing 11, between the 3rd layer, on an insulating layer 43, transparency conductivity thin films, such as an ITO film, are deposited on the thickness of about 500-2000Å by sputtering processing etc., and the pixel electrode 11 is further formed according to a photolithography production process, an etching production process, etc. In addition, when using the liquid crystal equipment 200 concerned for the liquid crystal equipment of a reflective mold, the pixel electrode 11 may be formed from an opaque material with high reflection factors, such as aluminum.

[0128] Then, after applying the spreading liquid of the orientation film of a polyimide system on the pixel electrode 11, the orientation film 12 shown in drawing 1 is formed by performing rubbing processing in the predetermined direction so that it may have a predetermined pre tilt angle etc.

[0129] Next, protection-from-light layer 3" explains formation of TFT202 portion of the precharge circuit 201 established in the TFT array substrate 1 side with reference to drawing 12 based on the B-B' cross section of drawing 8.

[0130] About formation of TFT202 portion of the precharge circuit 201, the production process (6) of drawing 11 is performed at the same thin film formation production process from formation of TFT30 portion explained with reference to drawing 10 and drawing 11, and the production process (1) of drawing 10. Therefore, the explanation is omitted.

[0131] in this case -- the -- two -- a layer -- between -- an insulating layer -- 42 -- annealing treatment -- giving -- until -- drawing 11 -- a production process -- (-- seven --) -- being the same -- although -- after that -- drawing 12 -- a production process -- (-- seven --) -- being shown -- as -- precharge -- a signal line -- 204 -- receiving -- a contact hole -- 37 -- " -- the data line -- 35 -- receiving -- a contact hole -- 38 -- " -- the production process (7) of drawing 11 -- being concurrent -- dry etching,

[0132] Next, as shown in the production process (8) of drawing 12, low resistance metal metallurgy group silicide, such as aluminum, etc. is deposited by sputtering processing etc. on an insulating layer 42 between the 2nd layer according to the same thin film formation production process as the production process (8) of drawing 11. Furthermore, in parallel to the production process (8) of drawing 11, the precharge signal line 204 and the data line 35 which have a predetermined pattern, respectively are formed according to a photolithography production process, an etching production process, etc.

[0133] Next, as shown in the production process (9) of drawing 12, while [the 3rd layer] consisting of silicate glass etc. according to the same thin film formation production process as the production process (9) of drawing 11 so that the data-line 35 and precharge signal-line 204 top may be covered, an insulating layer 43 is formed. And about transparency conductivity thin films, such as an ITO film deposited on an insulating layer 43 between the 3rd layer according to the

thin film formation production process of the production process (10) of drawing 11 , all are removed by etching processing etc.

[0134] In addition, since it is the same as that of formation of TFT202 portion of the above-mentioned precharge circuit 201 about formation of TFT302 portion of the sampling circuit 301 where protection-from-light layer 3" was prepared in the TFT array substrate 1 side, the explanation is omitted.

[0135] (Electronic equipment) Next, the gestalt of operation of electronic equipment equipped with the liquid crystal equipment 200 explained to details above is explained with reference to drawing 18 from drawing 13 .

[0136] The outline configuration of the electronic equipment which equipped drawing 13 with liquid crystal equipment 200 in this way is shown first.

[0137] In drawing 13 , electronic equipment is constituted in preparation for the liquid crystal equipment 200 and the clock generation circuit 1008 list in which the drive circuit 1004 including the source 1000 of a display information output, the display information processing circuit 1002, the above-mentioned scanning-line drive circuit 104, and the data-line drive circuit 101, the precharge circuit constituted as mentioned above, and the sampling circuit were established in the power circuit 1010. The source 1000 of a display information output outputs display information, such as a picture signal of a predetermined format, to the display information processing circuit 1002 based on the clock signal from the clock generation circuit 1008 including memory, such as ROM (Read Only Memory), RAM (Random Access Memory), and an optical disk unit, a tuning circuit, etc. The display information processing circuit 1002 is constituted including various well-known processing circuits, such as amplification and a polarity-reversals circuit, a phase expansion circuit, a rotation circuit, a gamma correction circuit, and a clamping circuit, carries out sequential generation of the digital signal from the display information inputted based on the clock signal, and outputs it to the drive circuit 1004 with a clock signal CLK. The drive circuit 1004 drives liquid crystal equipment 200 by the above-mentioned drive method the scanning-line drive circuit 104 and the data-line drive circuit 101. A power circuit 1010 supplies a predetermined power supply to each above-mentioned circuit. In addition, on the TFT array substrate which constitutes liquid crystal equipment 200, the drive circuit 1004 may be carried and, in addition to this, the display information processing circuit 1002 may be carried.

[0138] Next, the example of the electronic equipment constituted in this way from drawing 14 by drawing 18 is shown, respectively.

[0139] Three liquid crystal modules containing the liquid crystal equipment with which the drive circuit 1004 which the liquid crystal projector 1100 mentioned above was carried on the TFT array substrate at drawing 14 are prepared, the outline block diagram of the optical system of a projection mold projector used as liquid crystal equipments 962R, 962G, and 962B for RGB, respectively is shown, and drawing 15 is the E-E' cross section of drawing 14 . The light equipment 920 mentioned above and the homogeneity illumination-light study system 923 are adopted as the optical system of the projection mold display of this example. And the color separation optical system 924 as a color separation means by which a projection mold display separates into red (R), green (G), and blue (B) the flux of light W by which outgoing radiation is carried out from this homogeneity illumination-light study system 923, Three light valves 925R, 925G, and 925B as a modulation means to modulate each colored light bunches R, G, and B, It has the projector lens unit 6 as the color composition prism 910 as a color composition means to re-compound the colored light bunch after becoming irregular, and a delivery system which carries out expansion projection of the compounded flux of light on the surface of a plane of incidence 100. Moreover, it also has the light guide system 927 which leads the blue glow bunch B to corresponding light valve 925B.

[0140] The homogeneity illumination-light study system 923 is equipped with two lens boards 921 and 922 and reflective mirrors 931, and is arranged at the condition that two lens boards 921 and 922 intersect perpendicularly on both sides of the reflective mirror 931. Two lens boards 921 and 922 of the homogeneity illumination-light study system 923 are equipped with two or more rectangle lenses arranged in the shape of a matrix, respectively. The flux of light by which outgoing radiation was carried out from light equipment 920 is divided into two or more partial flux of lights by the rectangle lens of the 1st lens board 921. And these partial flux of lights are superimposed three light valves 925R and 925G and near 925B with the rectangle lens of the 2nd lens board 922. Therefore, even when it has illumination distribution with light equipment 920 uneven in the cross section of an outgoing beam by using the homogeneity illumination-light study system 923, it becomes possible to illuminate three light valves 925R, 925G, and 925B by the uniform illumination light.

[0141] Each color separation optical system 924 consists of a bluish green reflective dichroic mirror 941, a green reflective dichroic mirror 942, and a reflective mirror 943. First, in the bluish green reflective dichroic mirror 941, the blue glow bunch B included in the flux of light W and the green light bunch G are reflected by the right angle, and it goes to the green reflective dichroic mirror 942 side. This mirror 941 is passed, it is reflected by the right angle by the

back reflective mirror 943, and outgoing radiation of the red flux of light R is carried out to the prism unit 910 side from the outgoing radiation section 944 of the red flux of light R.

[0142] Next, in the green reflective dichroic mirror 942, the green light bunch G is reflected by the right angle among the blue reflected in the bluish green reflective dichroic mirror 941, and the green light bunches B and G, and outgoing radiation is carried out to a color composition optical-system side from the outgoing radiation section 945 of the green light bunch G. Outgoing radiation of the blue glow bunch B which passed the green reflective dichroic mirror 942 is carried out to the light guide system 927 side from the outgoing radiation section 946 of the blue glow bunch B. In this example, it is set up so that the distance from the outgoing radiation section of the flux of light W of a homogeneity illumination-light study element to the outgoing radiation sections 944, 945, and 946 of each colored light bunch in the color separation optical system 924 may become almost equal.

[0143] Condenser lenses 951 and 952 are arranged at the outgoing radiation side of the red of the color separation optical system 924, and the outgoing radiation sections 944 and 945 of the green light bunches R and G, respectively. Therefore, incidence of the red and the green light bunches R and G which carried out outgoing radiation from each outgoing radiation section is carried out to these condenser lenses 951 and 952, and they are made parallel.

[0144] Thus, incidence of the red and the green light bunches R and G which were made parallel is carried out to light valves 925R and 925G, they are modulated, and the image information corresponding to each colored light is added. That is, according to image information, switching control of these liquid crystal equipments is carried out by the non-illustrated driving means, and, thereby, the modulation of each colored light which passes through this is performed. Such a driving means can use a well-known means as it is. On the other hand, the blue glow bunch B is led to light valve 925B which corresponds through the light guide system 927, and a modulation is similarly performed in here according to image information. In addition, the light valves 925R, 925G, and 925B of this example are liquid crystal light valves which consist of the incidence side polarization means 960R, 960G, and 960B, outgoing radiation side polarization means 961R, 961G, and 961B, and liquid crystal equipments 962R, 962G, and 962B arranged among these further, respectively.

[0145] The light guide system 927 consists of a middle lens 973 arranged between the condenser lens 954 arranged to the outgoing radiation side of the outgoing radiation section 946 of the blue glow bunch B, the incidence side reflective mirror 971, the outgoing radiation side reflective mirrors 972, and these reflective mirrors, and a condenser lens 953 arranged to the near side of light valve 925B. From a condenser lens 946, through the light guide system 927, the blue glow bunch B by which outgoing radiation was carried out is led to liquid crystal equipment 962B, and is modulated. The blue glow bunch B becomes the longest, therefore the quantity of light loss of a blue glow bunch of distance from the optical path length of each colored light bunch, i.e., the outgoing radiation section of the flux of light W, to each liquid crystal equipments 962R, 962G, and 962B increases most. However, quantity of light loss can be controlled by making the light guide system 927 intervene.

[0146] Incidence of each colored light bunches R, G, and B modulated through each light valves 925R, 925G, and 925B is carried out to the color composition prism 910, and they are compounded here. And expansion projection is carried out on the surface of the plane of incidence 100 which has the light compounded by this color composition prism 910 in a position through the projector lens unit 906.

[0147] With the gestalt of this operation, to the liquid crystal equipments 962R, 962G, and 962B Since the protection-from-light layer is prepared in the TFT bottom, the liquid crystal equipment 962R concerned, The reflected light by the incident light study system in the liquid crystal projector based on the incident light from 962G and 962B, Even if a part of incident light which runs through an incident light study system carries out incidence from a TFT array substrate side as a return light after carrying out outgoing radiation from the reflected light from the surface of the TFT array substrate at the time of incident light passing, and other liquid crystal equipments Protection from light to channels, such as circumference circuits, such as TFT for switching of a pixel electrode or TFT of a sampling circuit, TFT of a PURICHAJINGU circuit, TFT of an inspection circuit or a data-line drive circuit, and a scanning-line drive circuit, can fully be performed.

[0148] For this reason, in a configuration, since it becomes unnecessary to arrange the film for return light prevention separately, or to perform return light prevention processing to a polarization means between each liquid crystal equipments 962R, 962G, and 962B and a prism unit even if it uses the prism unit suitable for a miniaturization for an incident light study system, small and when being simplified, it is very advantageous.

[0149] Moreover, with the gestalt of this operation, since the effect of the channel field on TFT by return light can be suppressed, it is not necessary to stick the polarization means which performed direct return light prevention processing to liquid crystal equipment. Then, as shown in drawing 14 and drawing 15, a polarization means is separated from liquid crystal equipment, one polarization means 961R, 961G, and 961B are stuck on the prism unit 910, and the

polarization means 960R, 960G, and 960B of another side can more specifically be stuck [formation and] on condenser lenses 953, 945, and 944. Thus, since the heat of a polarization means is absorbed in a prism unit by sticking a polarization means on a prism unit, the temperature rise of liquid crystal equipment can be prevented.

[0150] Moreover, since an air space is made by detaching and forming liquid crystal equipment, a polarization means, and between between liquid crystal equipment and a polarization means as shown in drawing 15 , From a cooling means for example, by sending in ventilation of cold blast etc. from the ventilation opening 990 between liquid crystal equipment and a polarization means by forming a cooling means in either a prism unit top or the bottom The temperature rise of liquid crystal equipment can be prevented further, and malfunction by the temperature rise of liquid crystal equipment can be prevented.

[0151] In drawing 16 , the personal computer 1200 of other example slack laptop types of electronic equipment is equipped with the main part 1204 with which the keyboard 1202 was incorporated while it has liquid crystal equipment 200 mentioned above in the top covering case and it holds CPU, memory, a modem, etc. further.

[0152] In drawing 17 , the drive circuit 1004 of the above-mentioned [other example slack pagers 1300 of electronic equipment] in the metal frame 1302 is held in the light guide [in which the liquid crystal equipment 200 which is carried at a TFT array substrate top and forms a liquid crystal module contains back light 1306a] 1306, circuit board 1308, 1st, and 2nd shield boards 1310 and 1312 or 2 elastic conductors 1314 and 1316, and a list with the tape carrier package tape 1318. In the case of this example, the above-mentioned display information processing circuit 1002 (refer to drawing 13) may be carried in the circuit board 1308, and may be carried on the TFT array substrate of liquid crystal equipment 200. Furthermore, it is also possible to carry the above-mentioned drive circuit 1004 on the circuit board 1308.

[0153] moreover, as shown in drawing 18 , in the case of the liquid crystal equipment 200 which carries neither the drive circuit 1004 nor the display information processing circuit 1002 To TCP (Tape Carrier Package)1320 mounted on the polyimide tape 1322, IC1324 including the drive circuit 1004 or the display information processing circuit 1002 It is also possible to connect physically and electrically through the anisotropy electric conduction film prepared in the periphery of the TFT array substrate 1, and to carry out production, sale, use, etc. as liquid crystal equipment.

[0154] ***** equipped with the video tape recorder of a liquid crystal television, a viewfinder mold, or a monitor direct viewing type, the car navigation equipment, the electronic notebook, the calculator, the word processor, the workstation, the cellular phone, the TV phone, POS terminal, and touch panel other than electronic equipment which were explained with reference to drawing 18 from drawing 14 above etc. is mentioned as an example of the electronic equipment shown in drawing 13 .

[0155] As explained above, according to the gestalt of this operation, the protection-from-light engine performance to return light etc. is high, and TFT with outstanding transistor characteristics can realize various kinds of electronic equipment equipped with the liquid crystal equipment in which high-definition image display is possible.

[0156]

[Effect of the Invention] Since the situation where originate in return light etc. in the 1st, 2nd, and 3rd switching elements which consist of TFT etc., for example, a photocurrent occurs, and a switching characteristic deteriorates is prevented beforehand according to this invention, high-definition image display becomes possible by the switching element with the outstanding switching characteristic. Furthermore, since there is no need of arranging a sampling circuit and a precharge circuit into the circumference portion of the 1st substrate into which it was put by the case of protection-from-light nature like before, it also becomes possible, for example by arranging these circuits under circumference abandonment to use effectively dead space called the bottom of circumference abandonment.

[0157] Moreover, since the situation where originate in return light etc., a photocurrent occurs in a semiconductor layer, and the transistor characteristics of TFT deteriorate is prevented beforehand, the high-definition image display of it becomes possible by TFT with outstanding transistor characteristics.

[Translation done.]

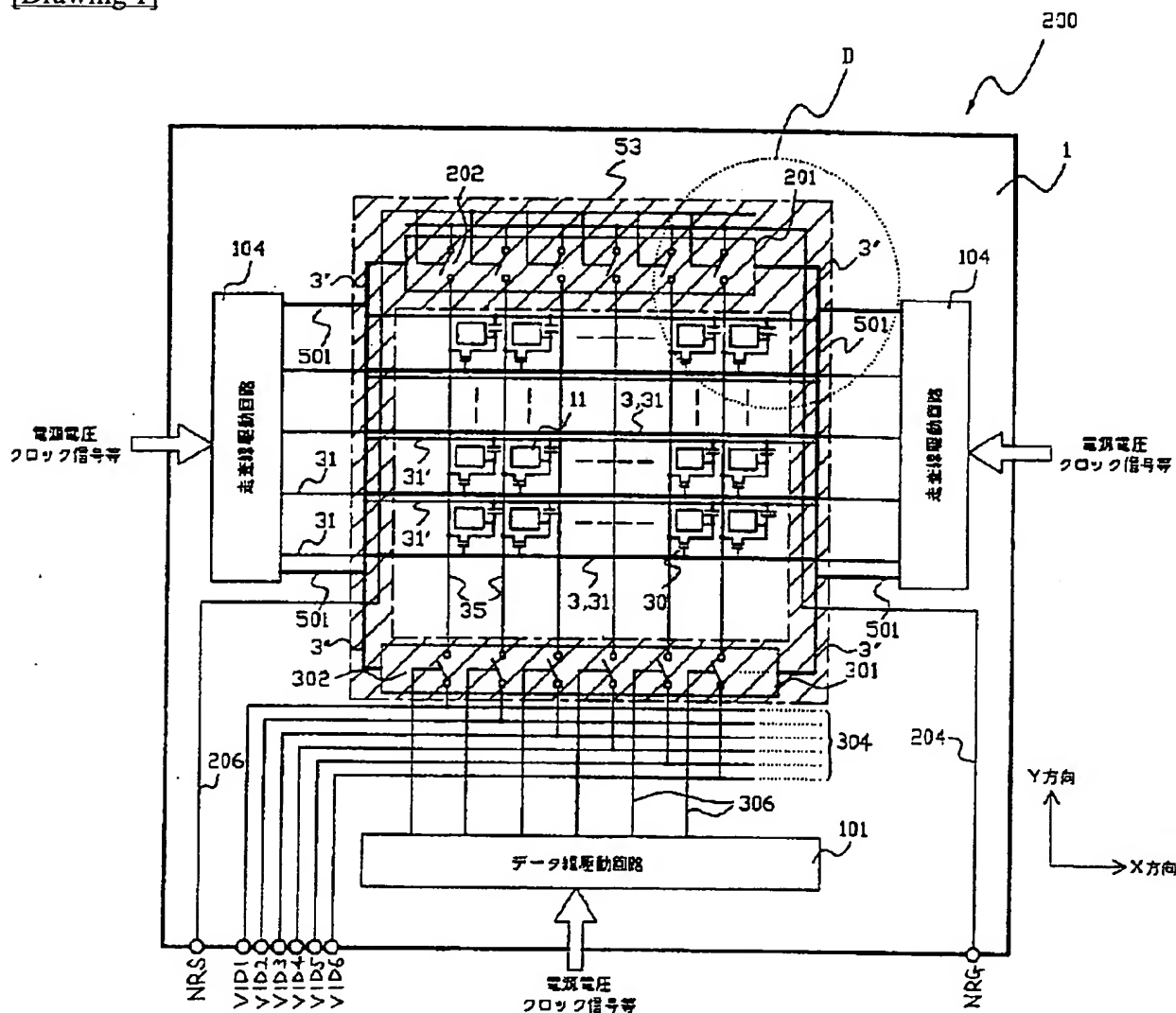
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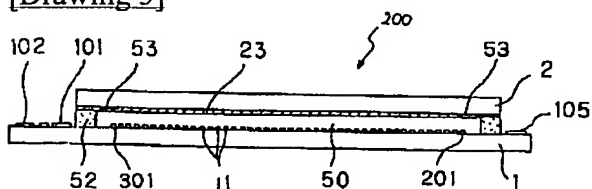
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DRAWINGS

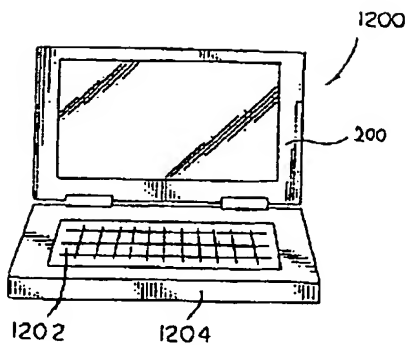
[Drawing 1]



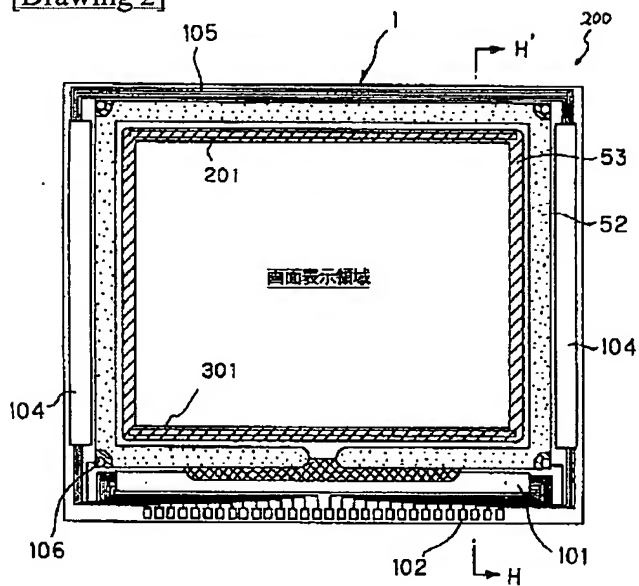
[Drawing 3]



[Drawing 16]



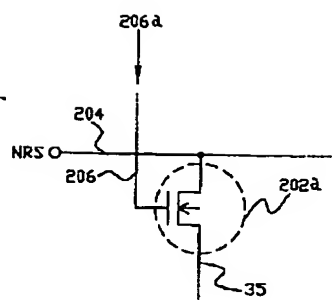
[Drawing 2]



[Drawing 4]

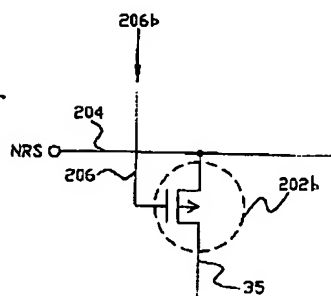
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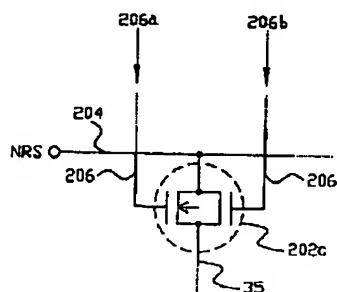
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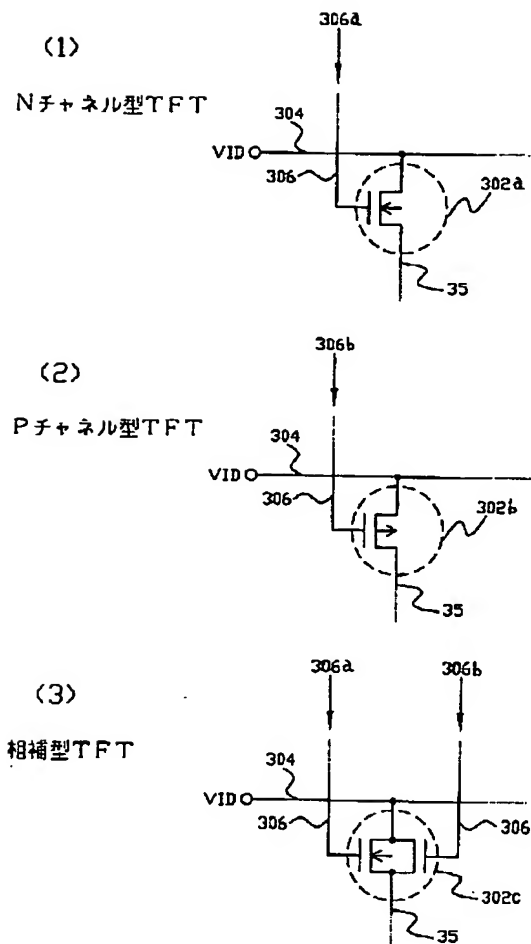


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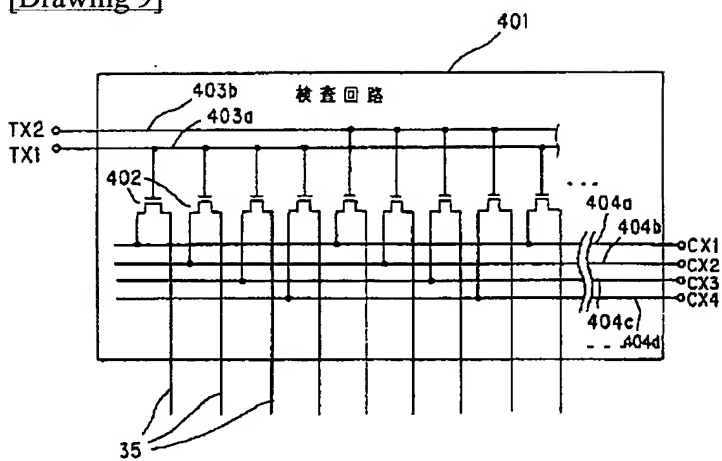
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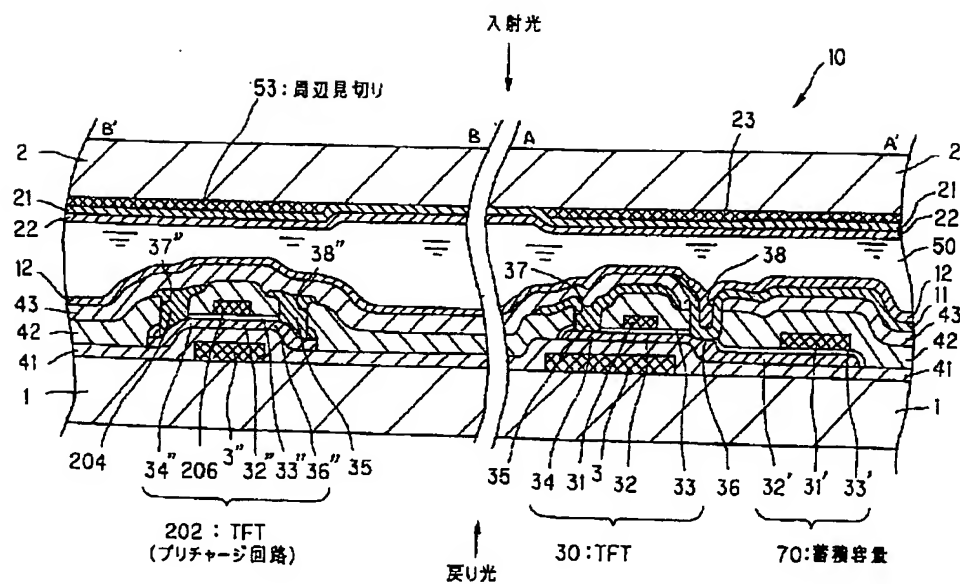
[Drawing.5]



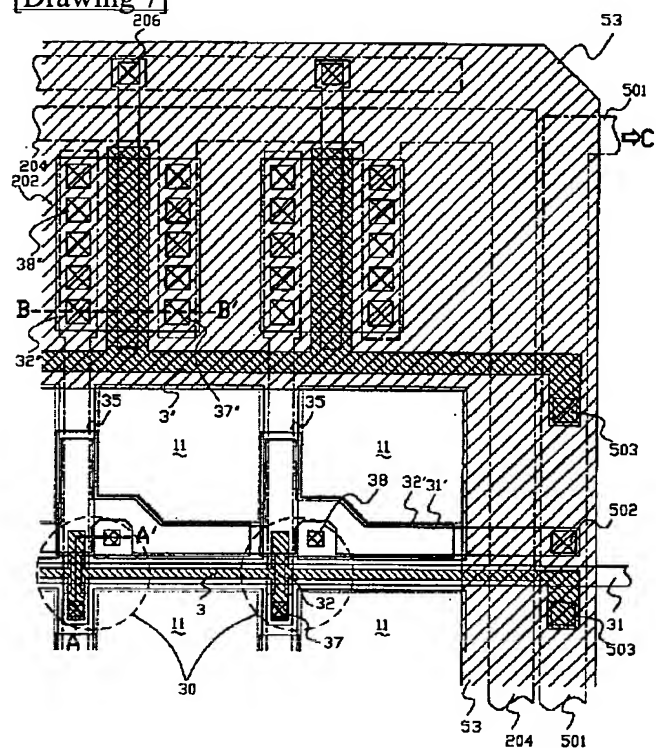
[Drawing 9]



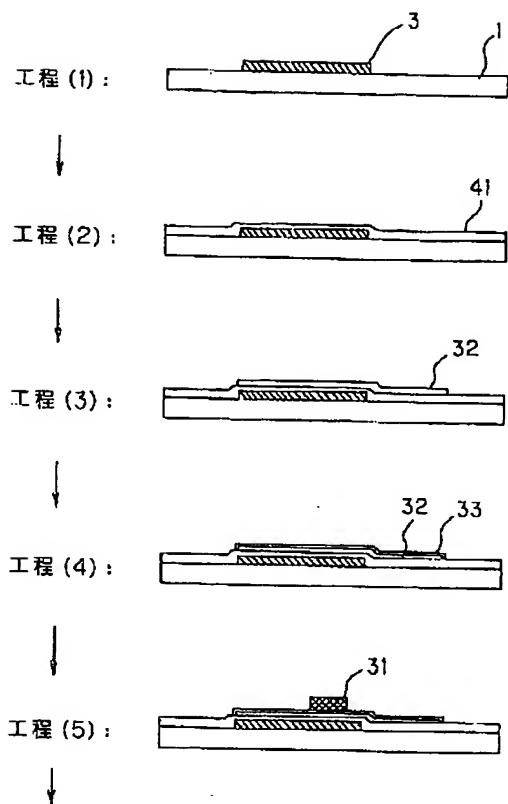
[Drawing 6]



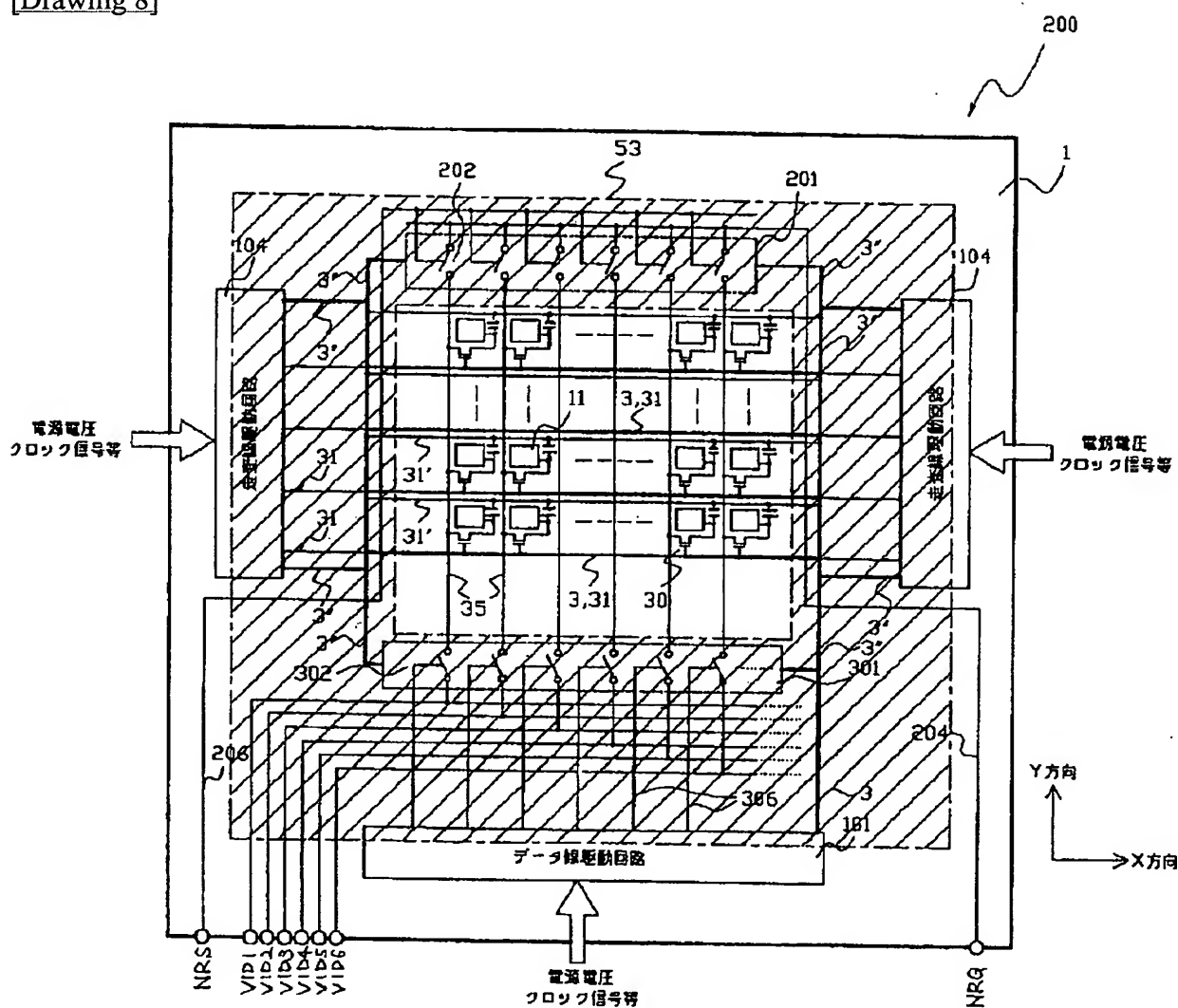
[Drawing 7]



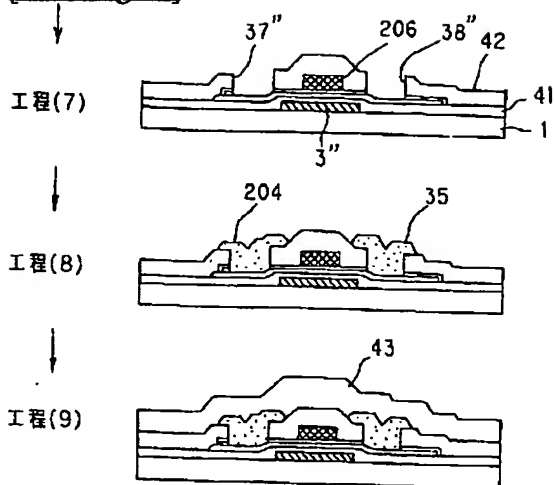
[Drawing 10]



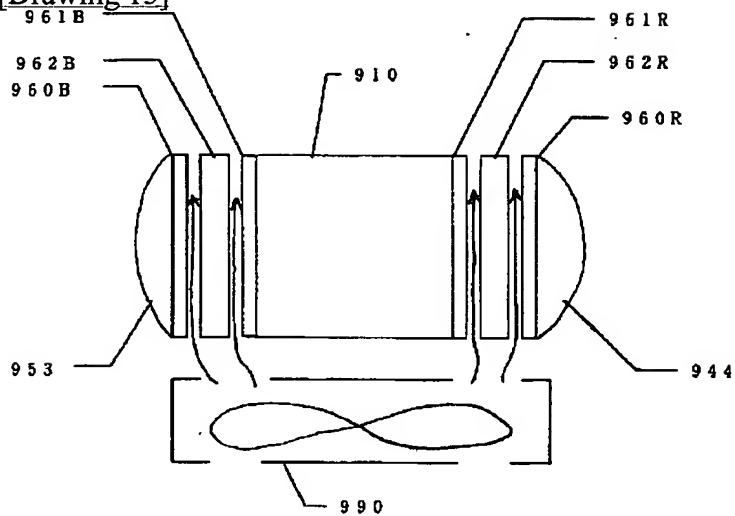
[Drawing 8]



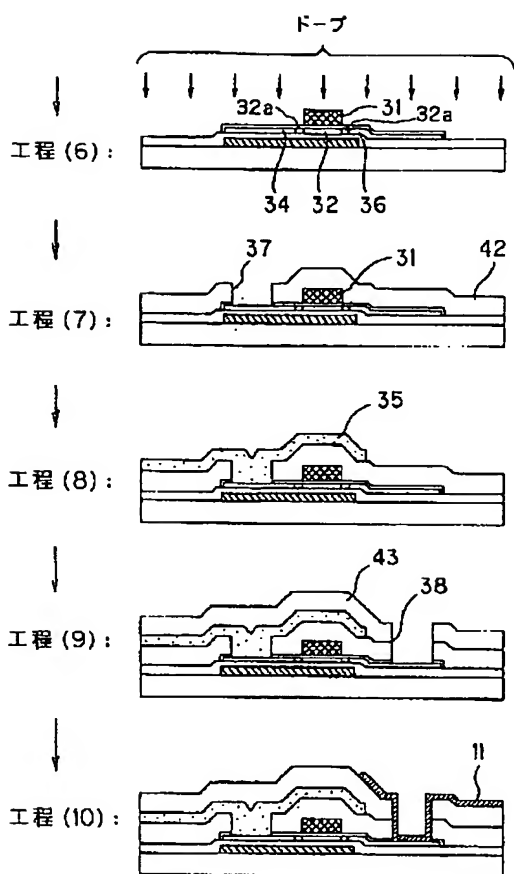
[Drawing 12]



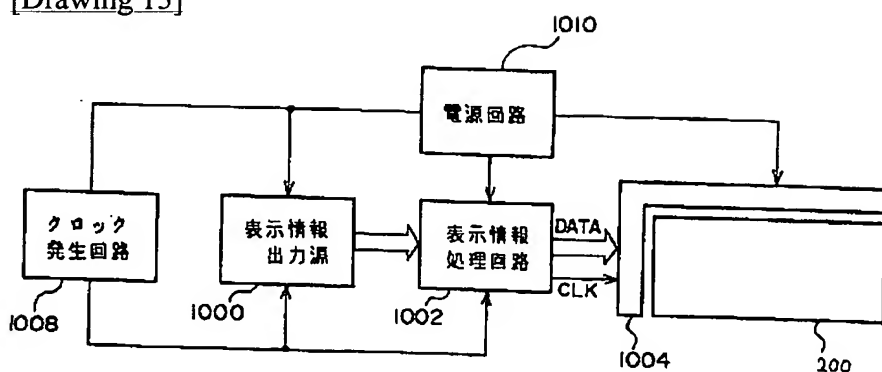
[Drawing 15]



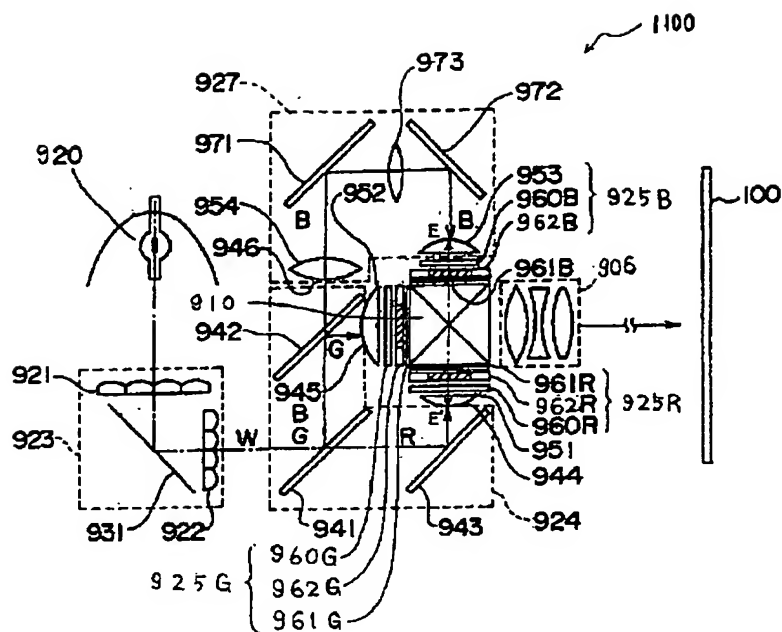
[Drawing 11]



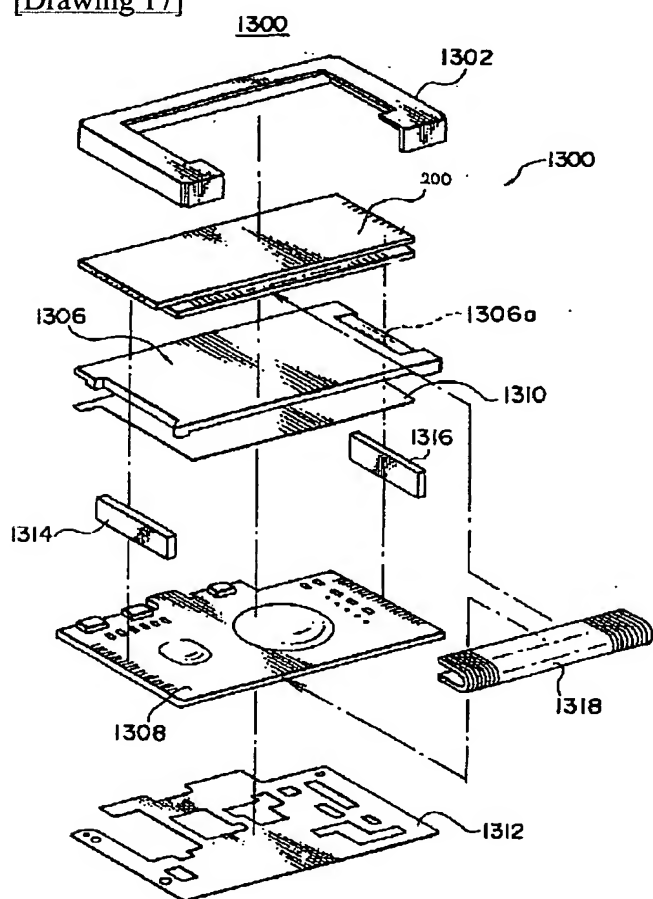
[Drawing 13]



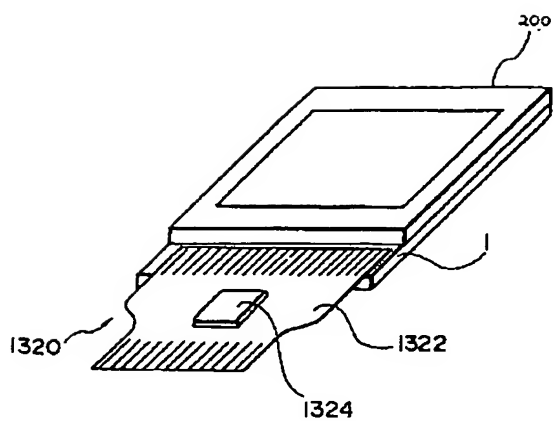
[Drawing 14]



[Drawing 17]



[Drawing 18]



[Translation done.]

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CORRECTION OR AMENDMENT

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 [Document to be Amended] Specification
 [Item(s) to be Amended] Claim
 [Method of Amendment] Modification
 [Proposed Amendment]
 [Claim(s)]

[Claim 1] It comes to pinch liquid crystal between the 1st and 2nd substrates of a pair, and has two or more pixel electrodes connected to two or more scanning lines, two or more data lines which intersect said two or more scanning lines, two or more 1st switching elements connected to two or more of said scanning lines and data lines, and said two or more 1st switching elements on said 1st substrate, One [at least] circuit is arranged at said 1st substrate among a sampling circuit which samples a picture signal by two or more 2nd switching elements, and is supplied to said two or more data lines, and a precharge circuit which precedes a precharge signal of a predetermined voltage level with said picture signal by two or more 3rd switching elements at said two or more data lines, and is supplied, respectively, Liquid crystal equipment characterized by having further a protection-from-light layer prepared in said 1st switching element list in a location which counters one [at least] element of said 2nd and 3rd switching elements which one [said / at least] circuit has, respectively, respectively between said 1st substrate and said 1st switching element, and one [this] element.

[Claim 2] At least one of said 1st, 2nd, and 3rd switching elements is liquid crystal equipment according to claim 1 characterized by including a semiconductor layer which constitutes this thin film transistor that consisted of a thin film transistor and was formed through an insulator layer on said protection-from-light layer.

[Claim 3] It is liquid crystal equipment according to claim 1 or 2 which at least one of said 1st, 2nd, and 3rd switching elements consists of a thin film transistor of LDD (Lightly Doped Drain) structure, and is characterized by preparing said protection-from-light layer in a location which counters a channel field and a LDD field of this thin film transistor at least.

[Claim 4] Said protection-from-light layer is liquid crystal equipment given in any 1 term of claims 1-3 characterized by crossing to the whole region and being formed from the same material of the same thin film formation production process.

[Claim 5] Said protection-from-light layer is liquid crystal equipment given in any 1 term of claims 1-4 characterized by connecting with a constant source of potential.

[Claim 6] Constant potential of said constant source of potential is liquid crystal equipment according to claim 5 characterized by being equal to touch-down potential.

[Claim 7] It has further a counterelectrode prepared in a side which meets said liquid crystal of said 2nd substrate, Constant potential of said constant source of potential is liquid crystal equipment according to claim 5 characterized by being equal to potential of said counterelectrode.

[Claim 8] At least one of said 1st, 2nd, and 3rd switching elements is liquid crystal equipment given in any 1 term of claims 1-7 characterized by consisting of a thin film transistor of any one mold in an N channel mold, a P channel mold, and a complementary type.

[Claim 9] A seal member which sticks said 1st and 2nd substrates in the perimeter of a screen-display field specified with said two or more pixel electrodes on a plane parallel to said 1st and 2nd substrates, and surrounds said liquid crystal,

It has further circumference abandonment of protection-from-light nature formed along with an outline of said screen-display field at said 2nd substrate between said seal members and said screen-display fields on said plane,

One [said / at least] circuit is liquid crystal equipment given in any 1 term of claims 1-8 characterized by being prepared in a location which counters said circumference abandonment.

[Claim 10] Said precharge circuit is prepared,

Said two or more data lines are liquid crystal equipment given in any 1 term of claims 1-9 characterized by supplying said precharge signal from the other side while said picture signal is supplied from one side of said data line.

[Claim 11] An inspection circuit containing the 4th switching element for conducting predetermined inspection to the liquid crystal equipment concerned is further established in said 1st substrate,

Said protection-from-light layer is liquid crystal equipment given in any 1 term of claims 1-10 characterized by being further prepared between said 1st substrate and said 4th switching element in a location which counters said 4th switching element.

[Claim 12] In liquid crystal equipment according to claim 1,

It replaces with one [said / at least] circuit, and a circumference circuit containing the 5th switching element for voltage maintenance for operating the liquid crystal equipment concerned is established in said 1st substrate,

Said protection-from-light layer is liquid crystal equipment characterized by being prepared between said 1st substrate and said 5th switching element in a location which counters said 5th switching element.

[Claim 13] Electronic equipment characterized by equipping either of claims 1-12 with liquid crystal equipment of a publication.

[Claim 14] In a projection mold display which has the light source, a liquid crystal light valve which incidence of the light by which outgoing radiation is carried out from this light source is carried out, and performs a modulation corresponding to image information, and a delivery system which projects light modulated with said liquid crystal light valve,

Said liquid crystal light valve has liquid crystal equipment with which liquid crystal was pinched between the 2nd substrate arranged at a 1st substrate [which has been arranged at an incidence side of light], and outgoing radiation side, the 1st polarization means arranged on the outside of said 1st substrate, and the 2nd polarization means arranged on the outside of said 2nd substrate,

On said 2nd substrate, it has two or more pixel electrodes connected to two or more scanning lines, two or more data lines which intersect said two or more scanning lines, two or more 1st thin film transistors connected to two or more of said scanning lines and data lines, and said two or more 1st thin film transistors,

Even if there are few said 1st thin film transistors between said 2nd substrate and said 1st thin film transistor, corresponding to a channel field, it comes to arrange a protection-from-light layer then,

A projection mold display characterized by coming to form space between said 2nd polarization means and said liquid crystal equipment.

[Claim 15] In the projection mold display which has the light source, a color-separation means separate into a colored-light bunch of at least 2 colors the flux of light by which outgoing radiation is carried out from this light source, the liquid-crystal light valve that perform a modulation corresponding to image information to the flux of light of each color separated by said color-separation means, a synthetic means compound the light modulated with said liquid-crystal light

valve, and the delivery system which project the synthetic flux of light by which outgoing radiation was carried out from said synthetic means,

Said liquid crystal light valve has liquid crystal equipment with which it comes to pinch liquid crystal between the 2nd substrate arranged at a 1st substrate [which has been arranged at an incidence side of light], and outgoing radiation side of light, the 1st polarization means arranged on the outside of said 1st substrate, and the 2nd polarization means arranged on the outside of said 2nd substrate,

On said 2nd substrate, it has two or more pixel electrodes connected to two or more scanning lines, two or more data lines which intersect said two or more scanning lines, two or more 1st thin film transistors connected to two or more of said scanning lines and data lines, and said two or more 1st thin film transistors,

Even if there are few said 1st thin film transistors between said 2nd substrate and said 1st thin film transistor, corresponding to a channel field, it comes to arrange a protection-from-light layer then,

Said 2nd polarization means is a projection mold display characterized by being stuck on said synthetic means.

[Procedure amendment 2]

[Document to be Amended] Specification

[Item(s) to be Amended] 0012

[Method of Amendment] Modification

[Proposed Amendment]

[0012]

[Means for Solving the Problem] In order that liquid crystal equipment of this invention may solve the above-mentioned technical problem, it comes to pinch liquid crystal between the 1st and 2nd substrates of a pair. On said 1st substrate Two or more scanning lines, two or more data lines which intersect said two or more scanning lines, and two or more 1st switching elements connected to two or more of said scanning lines and data lines, A sampling circuit which has two or more pixel electrodes connected to said two or more 1st switching elements, samples a picture signal by two or more 2nd switching elements, and is supplied to said two or more data lines, One [at least] circuit is arranged at said 1st substrate among precharge circuits which precede a precharge signal of a predetermined voltage level with said picture signal by two or more 3rd switching elements at said two or more data lines, and are supplied, respectively. In a location which counters one [at least] element of said 2nd and 3rd switching elements which one [said / at least] circuit has in said 1st switching element list, respectively It is characterized by having further a protection-from-light layer prepared, respectively between said 1st substrate and said 1st switching element, and one [this] element.

[Procedure amendment 3]

[Document to be Amended] Specification

[Item(s) to be Amended] 0013

[Method of Amendment] Modification

[Proposed Amendment]

[0013] According to the liquid crystal equipment of this invention, a sampling circuit samples a picture signal by two or more 2nd switching elements which consist of TFT etc., and supplies it to two or more data lines. A precharge circuit precedes the precharge signal of a predetermined voltage level with a picture signal by two or more 3rd switching elements which consist of TFT etc. at two or more data lines, and supplies it, respectively. One [at least] circuit is established in the 1st substrate among these sampling circuits and precharge circuits. Here, the protection-from-light layer is prepared in the location which counters one [at least] element of the 2nd and 3rd switching elements which one circuit has, respectively even if this ** cannot be found in the 1st switching element list between the 1st substrate, the 1st switching element, and one [this] element, respectively. Therefore, even if return light etc. carries out incidence from the 1st substrate side, before carrying out incidence to the 1st, 2nd, and 3rd switching elements which consist of TFT etc., for example, this return light etc. is shaded by the protection-from-light layer formed in the location which counters these, respectively. For this reason, the situation where a photocurrent occurs according to the photo-electric-conversion effect in the 1st, 2nd, and 3rd switching elements which consist of TFT etc., for example, and a switching characteristic deteriorates is prevented beforehand. Furthermore, in this way, since protection from light about a sampling circuit or a precharge circuit is given, the need of arranging these circuits into the circumference portion of the 1st substrate into which it was put by the case of protection-from-light nature like before is lost. For example, these circuits can also be arranged to a part for 1st set Itabe which counters circumference abandonment of the protection-from-light nature formed in the 2nd substrate.

[Procedure amendment 4]

[Document to be Amended] Specification

[Item(s) to be Amended] 0014

[Method of Amendment] Modification

[Proposed Amendment]

[0014] Moreover, it is characterized by the liquid crystal equipment of this invention containing the semiconductor layer which constitutes this thin film transistor that at least one of said 1st, 2nd, and 3rd switching elements consisted of a thin film transistor, and was formed through the insulator layer on said protection-from-light layer.

[Procedure amendment 5]

[Document to be Amended] Specification

[Item(s) to be Amended] 0015

[Method of Amendment] Modification

[Proposed Amendment]

[0015] According to the liquid crystal equipment of this invention, among the 1st, 2nd, and 3rd switching elements at least one Although the semiconductor layer which constitutes the thin film transistor (TFT) formed through the insulator layer on the protection-from-light layer is included, even if return light etc. carries out incidence from the 1st substrate side, before carrying out incidence to this semiconductor layer, this return light etc. is shaded by the protection-from-light layer formed in the location which counters this. For this reason, in this semiconductor layer, a photocurrent occurs according to the photo-electric-conversion effect, and the situation where the transistor characteristics of TFT deteriorate is prevented beforehand.

[Procedure amendment 6]

[Document to be Amended] Specification

[Item(s) to be Amended] 0016

[Method of Amendment] Modification

[Proposed Amendment]

[0016] Moreover, in the liquid crystal equipment of this invention, at least one of said 1st, 2nd, and 3rd switching elements consists of a thin film transistor of LDD structure, and it is characterized by preparing said protection-from-light layer in the location which counters the channel field and LDD field of this thin film transistor at least.

[Procedure amendment 7]

[Document to be Amended] Specification

[Item(s) to be Amended] 0017

[Method of Amendment] Modification

[Proposed Amendment]

[0017] According to the liquid crystal equipment of this invention, at least one of the 1st, 2nd, and 3rd switching elements consists of TFT of LDD structure, but Since the protection-from-light layer is prepared in the location which counters this channel field of TFT, and a LDD field at least Even if return light etc. carries out incidence from the 1st substrate side, before carrying out incidence to this channel field and a LDD field, this return light etc. is shaded by the protection-from-light layer formed in the location which counters these. For this reason, in this channel field and a LDD field, a photocurrent occurs according to the photo-electric-conversion effect, and the situation where the transistor characteristics of TFT deteriorate is prevented beforehand.

[Procedure amendment 8]

[Document to be Amended] Specification

[Item(s) to be Amended] 0018

[Method of Amendment] Modification

[Proposed Amendment]

[0018] Moreover, the liquid crystal equipment of this invention is characterized by crossing said protection-from-light layer to the whole region, and forming it from the same material of the same thin film formation production process.

[Procedure amendment 9]

[Document to be Amended] Specification

[Item(s) to be Amended] 0019

[Method of Amendment] Modification

[Proposed Amendment]

[0019] According to the liquid crystal equipment of this invention, although the protection-from-light layer is prepared to various kinds of switching elements, it goes across a protection-from-light layer throughout the, and it is formed from the same material of the same thin film formation production process. That is, it becomes possible to form the protection-from-light layer to various kinds of switching elements according to the same production process in the manufacturing process of the liquid crystal equipment concerned in this case.

[Procedure amendment 10]

[Document to be Amended] Specification

[Item(s) to be Amended] 0020

[Method of Amendment] Modification

[Proposed Amendment]

[0020] Moreover, the liquid crystal equipment of this invention is characterized by connecting said protection-from-light layer to the constant source of potential.

[Procedure amendment 11]

[Document to be Amended] Specification

[Item(s) to be Amended] 0021

[Method of Amendment] Modification

[Proposed Amendment]

[0021] According to the liquid crystal equipment of this invention, since the protection-from-light layer is connected to the constant source of potential, let a protection-from-light layer be constant potential. Therefore, potential fluctuation of a protection-from-light layer does not have a bad influence on a protection-from-light layer to switching elements, such as TFT by which opposite arrangement is carried out.

[Procedure amendment 12]

[Document to be Amended] Specification

[Item(s) to be Amended] 0022

[Method of Amendment] Modification

[Proposed Amendment]

[0022] Moreover, the liquid crystal equipment of this invention is characterized by the constant potential of said constant source of potential being equal to touch-down potential.

[Procedure amendment 13]

[Document to be Amended] Specification

[Item(s) to be Amended] 0023

[Method of Amendment] Modification

[Proposed Amendment]

[0023] According to the liquid crystal equipment of this invention, since a protection-from-light layer is made into touch-down potential, potential fluctuation of a protection-from-light layer does not have a bad influence on a protection-from-light layer to switching elements, such as TFT by which opposite arrangement is carried out.

[Procedure amendment 14]

[Document to be Amended] Specification

[Item(s) to be Amended] 0024

[Method of Amendment] Modification

[Proposed Amendment]

[0024] Moreover, the liquid crystal equipment of this invention is further equipped with the counterelectrode prepared in the side which meets said liquid crystal of said 2nd substrate, and constant potential of said constant source of potential is characterized by being equal to the potential of said counterelectrode.

[Procedure amendment 15]

[Document to be Amended] Specification

[Item(s) to be Amended] 0025

[Method of Amendment] Modification

[Proposed Amendment]

[0025] According to the liquid crystal equipment of this invention, since a protection-from-light layer is made into the potential of a counterelectrode, potential fluctuation of a protection-from-light layer does not have a bad influence on a protection-from-light layer to switching elements, such as TFT by which opposite arrangement is carried out.

[Procedure amendment 16]

[Document to be Amended] Specification

[Item(s) to be Amended] 0026

[Method of Amendment] Modification

[Proposed Amendment]

[0026] Moreover, the liquid crystal equipment of this invention is characterized by at least one of said 1st, 2nd, and 3rd switching elements consisting of a thin film transistor of any one mold in an N channel mold, a P channel mold, and a

complementary type.

[Procedure amendment 17]

[Document to be Amended] Specification

[Item(s) to be Amended] 0027

[Method of Amendment] Modification

[Proposed Amendment]

[0027] According to the liquid crystal equipment of this invention, at least one of the 1st, 2nd, and 3rd switching elements consists of TFT of any one mold in an N channel mold, a P channel mold, and a complementary type, but Since the protection-from-light layer is prepared in this location that counters TFT at least, even if return light etc. carries out incidence from the 1st substrate side, before [this] carrying out incidence to TFT, this return light etc. will be shaded by the protection-from-light layer formed in the location which counters this. For this reason, in this TFT, a photocurrent occurs according to the photo-electric-conversion effect, and the situation where the transistor characteristics of TFT deteriorate is prevented beforehand.

[Procedure amendment 18]

[Document to be Amended] Specification

[Item(s) to be Amended] 0028

[Method of Amendment] Modification

[Proposed Amendment]

[0028] Moreover, the seal member which the liquid crystal equipment of this invention sticks said 1st and 2nd substrates in the perimeter of the screen-display field specified with said two or more pixel electrodes on a plane parallel to said 1st and 2nd substrates, and surrounds said liquid crystal, It has further circumference abandonment of the protection-from-light nature formed along with the outline of said screen-display field at said 2nd substrate between said seal members and said screen-display fields on said plane, and one [said / at least] circuit is characterized by being prepared in the location which counters said circumference abandonment.

[Procedure amendment 19]

[Document to be Amended] Specification

[Item(s) to be Amended] 0029

[Method of Amendment] Modification

[Proposed Amendment]

[0029] According to the liquid crystal equipment of this invention, circumference abandonment of protection-from-light nature is formed along with the outline of a screen-display field at the 2nd substrate between the seal members and screen-display fields which surround liquid crystal. Here, among a sampling circuit and a precharge circuit, since one [at least] circuit is established in the location which counters circumference abandonment, if it is called circumference abandonment and says, a deployment of dead space can be aimed at. In this case, before carrying out incidence to the switching element which these sampling circuits and precharge circuits have even if incident light etc. carries out incidence from the 2nd substrate side since especially circumference abandonment is protection-from-light nature, this incident light etc. is shaded by circumference abandonment. Therefore, it originates in incident light etc. and there is no un-arranging [for which a photocurrent occurs according to the photo-electric-conversion effect in a switching element, and a switching characteristic deteriorates]. Thus, if a sampling circuit and a precharge circuit are arranged in the location which counters circumference abandonment, since it is not necessary to give protection from light to the light from the 2nd substrate side, it is very advantageous.

[Procedure amendment 20]

[Document to be Amended] Specification

[Item(s) to be Amended] 0030

[Method of Amendment] Modification

[Proposed Amendment]

[0030] Moreover, said two or more data lines are characterized by supplying said precharge signal from the other side while, as for the liquid crystal equipment of this invention, said precharge circuit is prepared and said picture signal is supplied from the one side of said data line.

[Procedure amendment 21]

[Document to be Amended] Specification

[Item(s) to be Amended] 0031

[Method of Amendment] Modification

[Proposed Amendment]

[0031] According to the liquid crystal equipment of this invention, a picture signal is supplied from the one side of said data line, and, as for two or more data lines, a precharge signal is supplied from the other side of said data line. Therefore, a precharge circuit can be established in an opposite side across the data-line drive circuit, sampling circuit, etc. and screen-display field for supplying a picture signal.

[Procedure amendment 22]

[Document to be Amended] Specification

[Item(s) to be Amended] 0032

[Method of Amendment] Modification

[Proposed Amendment]

[0032] Moreover, it is characterized by establishing further the inspection circuit containing the 4th switching element for the liquid crystal equipment of this invention conducting predetermined inspection to the liquid crystal equipment concerned in said 1st substrate, and preparing said protection-from-light layer further between said 1st substrate and said 4th switching element in the location which counters said 4th switching element.

[Procedure amendment 23]

[Document to be Amended] Specification

[Item(s) to be Amended] 0033

[Method of Amendment] Modification

[Proposed Amendment]

[0033] According to the liquid crystal equipment of this invention, the protection-from-light layer is prepared in the location which counters the 4th switching element which an inspection circuit has between the 1st substrate and this 4th switching element. Therefore, even if return light etc. carries out incidence from the 1st substrate side, before carrying out incidence to the 4th switching element which consists of TFT etc., for example, this return light etc. is shaded by the protection-from-light layer formed in the location which counters this, respectively. For this reason, in the 4th switching element which consists of TFT etc., for example, a photocurrent occurs according to the photo-electric-conversion effect, and the situation where a switching characteristic deteriorates is prevented beforehand. Furthermore, in this way, since protection from light about an inspection circuit is given, it can also arrange to a part for 1st set Itabe which counters circumference abandonment of the protection-from-light nature formed in the 2nd substrate.

[Procedure amendment 24]

[Document to be Amended] Specification

[Item(s) to be Amended] 0034

[Method of Amendment] Modification

[Proposed Amendment]

[0034] Moreover, it is characterized by replacing the liquid crystal equipment of this invention with one [said / at least] circuit, establishing the circumference circuit containing the 5th switching element for the voltage maintenance for operating the liquid crystal equipment concerned in said 1st substrate, and preparing said protection-from-light layer between said 1st substrate and said 5th switching element in the location which counters said 5th switching element.

[Procedure amendment 25]

[Document to be Amended] Specification

[Item(s) to be Amended] 0035

[Method of Amendment] Modification

[Proposed Amendment]

[0035] According to the liquid crystal equipment of this invention, the protection-from-light layer is prepared in the location which counters the 5th switching element which a circumference circuit has between the 1st substrate and this 5th switching element. Therefore, even if return light etc. carries out incidence from the 1st substrate side, before carrying out incidence to the 5th switching element which consists of TFT etc., for example, this return light etc. is shaded by the protection-from-light layer formed in the location which counters this, respectively. For this reason, the situation where a photocurrent occurs according to the photo-electric-conversion effect in the 5th switching element which consists of TFT etc., for example, a switching characteristic deteriorates, and maintenance voltage changes is prevented beforehand. Furthermore, in this way, since protection from light about a circumference circuit is given, it can also arrange to a part for 1st set Itabe which counters circumference abandonment of the protection-from-light nature formed in the 2nd substrate.

[Procedure amendment 26]

[Document to be Amended] Specification

[Item(s) to be Amended] 0036

[Method of Amendment] Modification

[Proposed Amendment]

[0036] It is characterized by equipping the electronic equipment of this invention with the liquid crystal equipment of the above-mentioned publication.

[Procedure amendment 27]

[Document to be Amended] Specification

[Item(s) to be Amended] 0037

[Method of Amendment] Modification

[Proposed Amendment]

[0037] According to the electronic equipment of this invention, electronic equipment is equipped with the liquid crystal equipment of the invention in this application mentioned above, and since various kinds of actuation is performed by the switching element in which the protection-from-light engine performance to return light etc. has the highly excellent switching characteristic, the high-definition image display of it becomes possible.

[Procedure amendment 28]

[Document to be Amended] Specification

[Item(s) to be Amended] 0038

[Method of Amendment] Modification

[Proposed Amendment]

[0038] The liquid crystal light valve with which incidence of the light to which outgoing radiation of the projection mold display of this invention is carried out from the light source and this light source is carried out, and it performs the modulation corresponding to image information, In the projection mold indicating equipment which has the delivery system which projects the light modulated with said liquid crystal light valve said liquid crystal light valve The liquid crystal equipment with which liquid crystal was pinched between the 2nd substrate arranged at the 1st substrate [which has been arranged at the incidence side of light], and outgoing radiation side, It consists of the 1st polarization means arranged on the outside of said 1st substrate, and the 2nd polarization means arranged on the outside of said 2nd substrate. On said 2nd substrate Two or more scanning lines, two or more data lines which intersect said two or more scanning lines, and two or more 1st thin film transistors connected to two or more of said scanning lines and data lines, It has two or more pixel electrodes connected to said two or more 1st thin film transistors. Between said 2nd substrate and said 1st thin film transistor, it is characterized by the thing of said 1st thin film transistor which come to arrange a protection-from-light layer at least corresponding to a channel field, and it comes to form space between said 2nd polarization means and said liquid crystal equipment.

[Procedure amendment 29]

[Document to be Amended] Specification

[Item(s) to be Amended] 0039

[Method of Amendment] Modification

[Proposed Amendment]

[0039] According to the projection mold indicating equipment of this invention, the leakage current by return light can be prevented by forming a protection-from-light layer between the 2nd substrate and the 1st thin film transistor.

Moreover, since the effect on the liquid crystal light valve by return light can be prevented, it is not necessary to stick a polarization means with an antireflection film on liquid crystal equipment like before. therefore -- without it sticks the 2nd polarization means on liquid crystal equipment -- alienation -- since it can form, the temperature rise of a liquid crystal light valve can be prevented.

[Procedure amendment 30]

[Document to be Amended] Specification

[Item(s) to be Amended] 0040

[Method of Amendment] Modification

[Proposed Amendment]

[0040] Moreover, a color separation means by which the projection mold display of this invention separates into the colored light bunch of at least 2 colors the flux of light by which outgoing radiation is carried out from the light source and this light source, The liquid crystal light valve which performs the modulation corresponding to image information to the flux of light of each color separated by said color separation means, In the projection mold display which has a synthetic means to compound the light modulated with said liquid crystal light valve, and the delivery system which projects the synthetic flux of light by which outgoing radiation was carried out from said synthetic means The liquid crystal equipment with which it comes to pinch liquid crystal between the 2nd substrate arranged at the 1st substrate

[with which said liquid crystal light valve has been arranged at the incidence side of light], and outgoing radiation side of light, It has the 1st polarization means arranged on the outside of said 1st substrate, and the 2nd polarization means arranged on the outside of said 2nd substrate. On said 2nd substrate Two or more scanning lines, two or more data lines which intersect said two or more scanning lines, and two or more 1st thin film transistors connected to two or more of said scanning lines and data lines, It has two or more pixel electrodes connected to said two or more 1st thin film transistors. Between said 2nd substrate and said 1st thin film transistor, it is characterized by the thing of said 1st thin film transistor for which it comes to arrange a protection-from-light layer at least corresponding to a channel field, and said 2nd polarization means is stuck on said synthetic means.

[Procedure amendment 31]

[Document to be Amended] Specification

[Item(s) to be Amended] 0041

[Method of Amendment] Modification

[Proposed Amendment]

[0041] According to the projection mold display of this invention, since the 2nd polarization means is stuck on the synthetic means, space is formed between liquid crystal equipment and the 2nd polarization means. Therefore, the temperature rise of liquid crystal equipment can be avoided and malfunction of a liquid crystal light valve can be prevented.

[Procedure amendment 32]

[Document to be Amended] Specification

[Item(s) to be Amended] 0042

[Method of Amendment] Modification

[Proposed Amendment]

[0042] As for the projection mold display of this invention, said synthetic means may consist of a prism unit.

[Procedure amendment 33]

[Document to be Amended] Specification

[Item(s) to be Amended] 0043

[Method of Amendment] Modification

[Proposed Amendment]

[0043] According to this projection mold display, said synthetic means consists of a prism unit, and the 2nd polarization means is stuck on the prism unit. The prism unit is effective in order to be able to absorb the heat capacity of the 2nd polarization means in a prism unit since heat capacity is large, and to prevent the temperature rise of a liquid crystal light valve.

[Procedure amendment 34]

[Document to be Amended] Specification

[Item(s) to be Amended] 0044

[Method of Amendment] Modification

[Proposed Amendment]

[0044] Moreover, the projection mold display of this invention is good to have further a cooling means to send cold blast between said liquid crystal equipment and said 2nd polarization means.

[Procedure amendment 35]

[Document to be Amended] Specification

[Item(s) to be Amended] 0045

[Method of Amendment] Modification

[Proposed Amendment]

[0045] According to this projection mold display, by forming a cooling means, for example in either a synthetic means top or the bottom, and sending cold blast between liquid crystal equipment and a polarization means from a cooling means, the temperature rise of a liquid crystal light valve can be prevented further, and malfunction of a liquid crystal light valve can be prevented.

[Translation done.]